PRE-API NUMBER

the OIL AND GAS JOURNAL

PUBLISHED WEEKLY NOVEMBER 14, 1960

OPERATION

"Cost Cutting"

How the industry is meeting today's most challenging problem: Making a profit P. 131

How Kennedy's Election Will Affect Oil ▸ 101

Cities Service Reorganizing for Growth ▸ 110

What Makes a Good Service-Station Operator ▸ 120

Closed-Loop Computer Runs an Ammonia Plant ▸ 148

ROCKWELL "1600" *Aluminum* GAS METER

100 PSI WORKING PRESSURE

Easy on the thighs

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For convenience, durability and ease of handling in the field, there's nothing to compare with the Rockwell "1600." This meter weighs only 63 lbs, so is easy to carry onto location and install. Weathering is no problem to the sturdy outer aluminum case: neither are the bumps and knocks encountered in field service. With it you get a generous capacity rating of 1600 cfh at 4 oz inlet pressure. You can increase this rating materially by measuring gas at higher pressures—up to 100 psi.

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another fine product by

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OIL AND GAS JOURNAL
Vol. 58, No. 46

Contents November 14, 1960

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TECHNOLOGY—OPERATION

SPECIAL SECTION: Cost Cutting in the Oil Industry 131-142

The domestic demand, which for years expanded at the rate of 6% or more per year, has slowed to about a 3% annual increase. The result of this curtailed increase in demand is that oil companies which had built up a massive momentum have overshot the mark. The correction is found in cost cutting. And this shaving of the cost of doing business extends across the board, with exploration being hit the hardest.

A positive effect of cost cutting concerns doing a job better. New information and new methods are available which make this a most promising avenue of approach.

Refining-Processing

World's Biggest Crude Unit Nears Computer Control 143

By G. L. Farrar

The 140,000-bbl. Whiting, Ind., unit of Indiana Standard is on computer open-loop control. The computer is optimizing operations after reading 196 instruments every 4 minutes and comparing the instrument readings with 75,000 stored instructions.

Ammonia Plant Features Closed-Loop Computer Control 148

By H. C. Bozeman

The unit has been on closed-loop control since January 1960, and production has increased appreciably at the 500-ton per day unit at Barton plant of Monsanto Chemical Co. near Luling, La.

Process Costimating—83 161

Cost of chemicals for light-oil treating.

Drilling-Production

Here's How Kerr-McGee Handles Offshore Condensate 157

By W. B. Bleakley

Specially built separation and delivery points collect, separate, and distribute gas and liquids from offshore condensate wells. Platform instrumentation permits remote control of producing wells and other parts of the system.

Oil-Well Pumping—22 164

By Joseph Zaba

Plunger travel for the sucker-rod pump.

Bit Weight and Rotary Speed for Lowest Cost Drilling 167

By E. M. Galle and H. B. Woods

Here are what are believed to be the best available empirical equations for the effects of weight, r.p.m., and tooth dullness on drilling rate, tooth wear, and bearing wear. They provide a sound basis for calculations which yield lowest possible cost. The findings clear the last big hurdle that has prevented drilling from becoming a true science.

Pipelining

Cutting Pipeline Costs 139

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Nov. 14, 1960

Cost cutting is near the end of an era:

Dramatic results have been achieved in the oil industry since 1958 by trimming the fat from company operations.

The reductions came primarily from cutbacks in exploration, development drilling, and payroll paring.

But these expedient measures are fading. They won't have much further effect in massive cost reduction.

Indications mount that the industry now is turning to other means of lowering costs. Future opportunities lie in new techniques and new concepts of operation aimed at greater efficiency in all departments (p. 131)*.

▼ ▼ ▼

Fuel cells will find widespread application in this decade, an authoritative study just published by graduate students of the Harvard Business School predicts.

The applications: In powering fork-lift trucks, city delivery trucks, heavy construction equipment, tugboats, ferries, taxicabs, and perhaps autos and locomotives.

Unlikely applications: Aircraft and high horsepower outboard-motor boats.

The report adds one word of caution. Before fuel cells are widely accepted in conventional power applications, use of less expensive fuels, such as hydrocarbons (propane or ethane) and air will have to be achieved.

▼ ▼ ▼

Watch for Canadian crude imports to continue to gain in Districts I-IV.

For the past year and one-half, more Canadian crude has been refined in Michigan, Minnesota, and Wisconsin than in the three new refineries built in the Pacific Northwest specifically to use Canadian imports.

A new factor also has arisen: Canadian crude now is competitive with U. S. crude in the Detroit-Toledo area and movements into that important refining center can be expected.

---

*Refers to article in this issue giving more details. When no page is given, the item is a Newsletter exclusive.

A storm in Venezuela? The entire board of Argentina's YPF has resigned in protest over a decree by President Arturo Frondizi opening YPF reserved lands on the south flank of Comodoro Rivadavia fields to development by private firms.

▼ ▼ ▼

Don't be surprised if the Texas Railroad Commission makes some sharp changes in the type of stocks data it will require from crude-producing companies next March.

The commission's recent soundings of actual and desired stock levels of individual companies—in August and October—are in pronounced conflict with desired levels for industry as a whole given by the same companies last spring.

Some sources predict the commission will abandon as unrealistic its traditional spring request for each company to estimate the national desired levels of crude and product stocks.

Tempo of oil wage talks will pick up this month. OCAW district directors report several negotiation sessions have been scheduled with oil companies for the first half of November.

Bargaining on OCAW's lone national oil contract with Sinclair will begin in Kansas City on November 14. Talks will concern about 9,000 OCAW members in Sinclair plants. The union will be in a position to serve strike notice any time after December 5.

First talks with oil companies over the union's 18-cent an hour wage request were held in October. No companies have made wage offers yet.

More earnings reports for 9 months: Pure, up 5% to $20.2 million from $19.2 million last year; California Standard, up to $199.2 million from $180.1 million; Ohio Standard, up 21% to $17.5 million from $14.5 million; Union up 19% to $23.7 million from $19.9 million.

Earnings for third quarter only: Amerada, up to $5.95 million from $5.90 million; Signal, up to $4.3 million from $3.8 million.

▼ ▼ ▼

Ferrofining, an improved lube-oil-finishing process, has been developed by British Petroleum Co., Ltd.

Lubes can be made without producing a solid waste by-product which requires disposal. The new process makes use of a specially developed catalyst which allows hydrotreating to be used as a finishing process for both solvent-refined and straight-distillate lubricants.

First plant to use Ferrofining will be built at the Dunkirk refinery of Societe Francaise des Petroles, BP. It will have a capacity of 3,000 bbl. daily.

Cubans are having trouble operating the 38,500-bbl. Esso refinery seized by the Castro regime. There have been repeated and prolonged breakdowns due to corrosion trouble, according to word filtering back to New York. But the plant still has not shut down completely.

Scandinavia is proving popular for new refineries. Royal Dutch-Shell plans a new plant in either Denmark or Norway. It has an option on land near Frederica, on the East Coast of Jutland for a 40,000-bbl. plant, but decision on site is not final.

Gulf also plans a 30,000-bbl. plant in either Denmark or Sweden, and has options on sites in both countries. Tidewater already has a 20,000-bbl. plant under construction at Kalundborg, Denmark.

A slight increase in production has resulted at the first chemical plant to be computer-controlled.

Its performance is being watched closely on the 500-ton per day ammonia unit at Monsanto's Barton plant near Luling, La. It has been on closed-loop computer control since early January. The computer calculates and sets the set points for the instruments every 16 minutes (p. 148).

▼ ▼ ▼

West Central Texas gas producers are making headway in their joint effort to find a new big pipeline market for their gas.

So far, 43 operators in 13 counties have pledged proved and uncommitted gas reserves totaling more than 492 billion cubic feet to any reasonable market. Two large interstate pipelines are ready to extend lines to the area when available reserves reach 750 billion cubic feet (p. 104).

Management notes: Corporate reshuffle and streamlining are expected for Cities Service after company is freed next month from holding company act (p. 110)...Lion Oil Co. has come up with plan to give financial rewards to geologists and geophysicists who can find oil but don't want to move up into administrative jobs (p. 108)...New survey shows keys to operating successful service station are sufficient capital, incentive plans, sales promotions, good bookkeeping plus hard work and plenty of service (p. 120)...Tidewater has declared a moratorium on dividend payments (p. 117)...Sun Oil has completed the world's biggest mined storage system with dedication of the largest cavern ever hewn from a single shaft (p. 112)...Army tests on multiple engines so far show the speed range in limited and flexibility of operations is not as good as in conventional engines. Army's aim is to have vehicles that will operate on a wide range of gasoline and compression-ignition engine fuel.

Market Memo

Nov. 14, 1960

Product prices are surprisingly good for API time.

Prices are generally holding firm because refiners cannot afford to start discounting posted prices. Buyers are balking. So the market is on dead center, and prices are marking time until demands make new price trends.

Middle distillates are steady at posted prices, despite pressure from too warm weather and soft East Coast prices.

Gasoline prices lack support from interrefinery buying.

In the Gulf Coast, the posted price for 92-RON gasoline is 11.25 cents per gallon. No recent sales have been made to confirm the posting, however.

Middle distillates are firm at 8.25 cents for No. 2 in a no-discount market not withstanding East Coast downward price adjustments.

Both gasoline and No. 2 in cargo lots await the test of some good sales.

No. 6 features the posted market strength at $2.30 per barrel with no appreciable offerings in the market.

Midwest refiners are still hoping for colder weather. While awaiting for it to come, they are holding fairly firm on all posted prices.

Gasoline movements are good for early November; and discounts, while available from limited sources, are not sufficient to change the posted price of 12.50 cents for 91-RON gasoline for northern shipment out of Group 3.

No. 1 and No. 2 are generally firm at their posted levels of 10 cents and 9 cents respectively for the group.

In Chicago during the past week prices have been undetermined due to discount offerings on gasoline and middle distillates.

Pressure from price cutting on tank wagon sales of middle distillates at this time is cause for further concern. However, posted prices for Chicago remain unchanged with 92-RON gasoline at 12.625 cents; No. 1 at 10.25 cents and No. 2 at 9.50 cents.

River markets continue in the doldrums.

Gasoline inquiries are hard to find, and there is not enough activity on No. 1 and No. 2 to set a firm price trend.

Buyers remain unwilling to pay Gulf Coast low posted price of 8.25 cents for No. 2 in the Helena-Memphis area and refiners can ill afford to sell even at that price basis.

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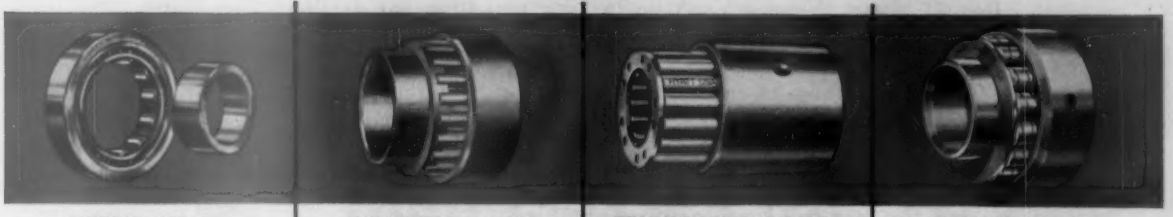
Whatever your roller bearing problem, you'll find a type to solve it in America's most complete line of cylindrical bearings—HYATT Hy-Rolls! Their greater load capacity is particularly helpful when heavy loads must be carried in cramped quarters. To save space, inner or outer races can be omitted from separable types. Shouldered-race types will also take thrust and locate heavy shafts dependably. You can *depend* on the advice of your HYATT Sales Engineer—and the bearings he recommends! Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.



METRIC SERIES

High-capacity cylindrical roller bearings for heavy radial loads and light or intermittent thrust loads.

INDUSTRIAL INCH

Designed for slow-moving, heavily loaded machinery where large-diameter shafts are usually employed.

TRUNNIONED ROLLER

For industrial trucks, textile machinery, gear pumps, conveyors, hoists, agricultural equipment, etc.

WOUND ROLLER

A three-part separable bearing which provides maximum resistance to shock, abrasion and fatigue.

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In Sizes from ¾" OD to 14" OD—HYATT offers a wide variety of bearing types and sizes—each quality-designed and quality-controlled to provide longer life.

For Loads up to 100,000 Lbs.—From small bearings for lawn mowers to heavy-duty types used in giant industrial cranes, HYATT builds bearings to carry any kind of radial load.

6 BUILT-IN BENEFITS: ★ Higher radial load capacity ★ Minimum space requirements ★ Omitted races are optional ★ Shaft location without sacrificing load capacity ★ Easier assembly and disassembly ★ Heavier press fits simplify retainment.

Available through United Motors System and its Independent Bearing Distributors

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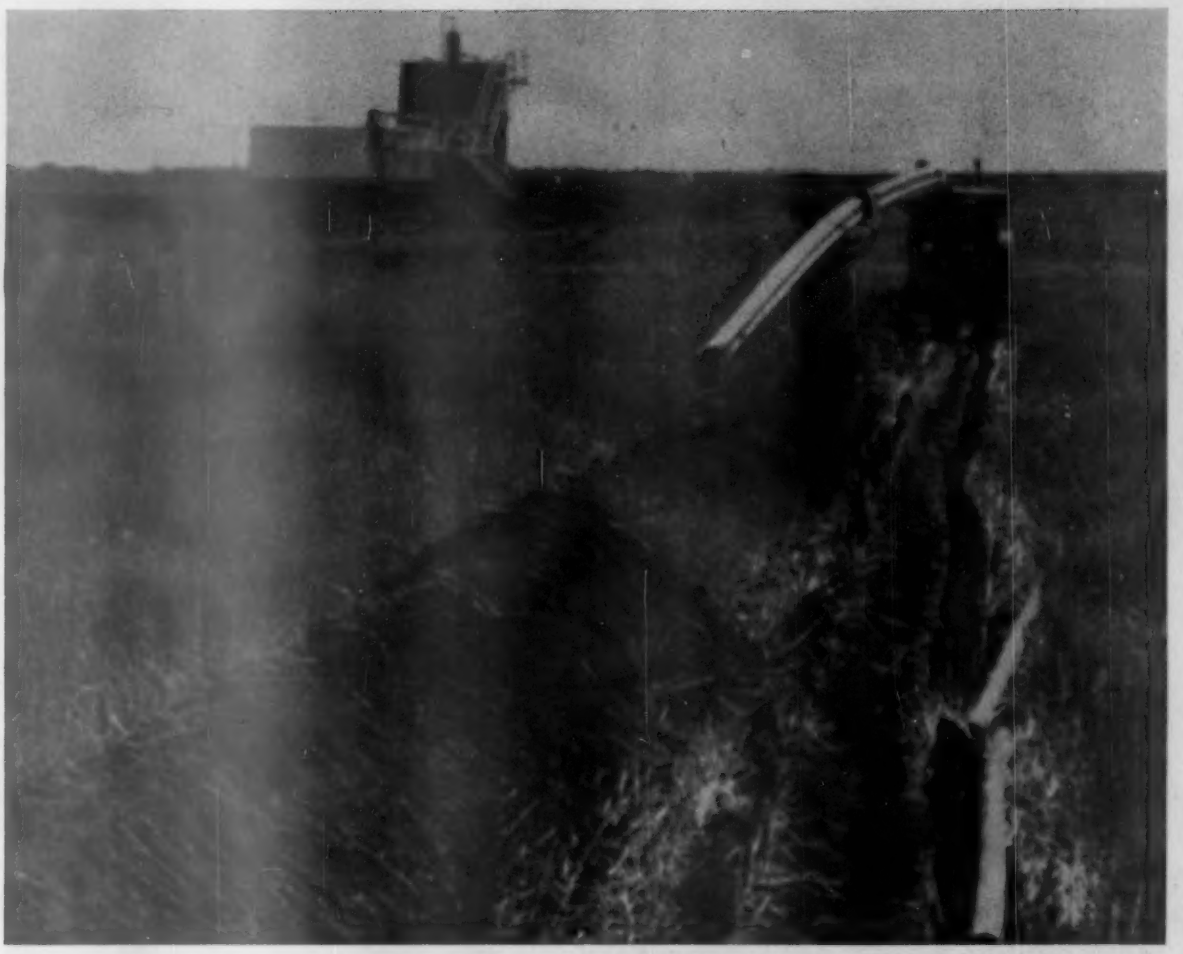

One man carries it, two men connect it

Koroseal PVC pipe is fast and easy to install—won't corrode, can't rust or rot, doesn't clog up

THOSE men are installing 1000 feet of pipe as a lead line between a new oil well and the tank battery. The pipe is Koroseal PVC—so light that one man carries five lengths of it without strain. So easy to connect that two men did the whole job in just a few hours.

Actually, it takes less than a minute for a two-man crew to get Koroseal pipe in position, apply solvent cement with a brush, and push two 20-foot sections together in a slipsleeve fitting.

But what makes Koroseal PVC pipe particularly ideal for oilfield use is its exceptional resistance to sour crude oil, salt water, chemicals and corrosion. Bury it in the most severe acid or alkali soil, and Koroseal will not rust or deteriorate in any way. Its smooth internal surface reduces flow resistance, and virtually eliminates buildup of paraffin that clogs other pipes.

With all these advantages you might expect to pay more for a Koroseal pipe. But the fact is Koroseal costs less than standard steel pipe wrapped for corrosion protection. For full information on Koroseal PVC pipe, write *B.F.Goodrich Industrial Products Co., Dept. M-932, Akron 18, Ohio.*

Koroseal—T.M. Reg. U.S. Pat. Off.

Koroseal rigid PVC products by B.F.Goodrich

NEW RUST-BAN® 190

Now you can get offshore corrosion protection with remarkable economy, measured by cost per year of satisfactory service. • *New* Humble RUST-BAN 190, a 100% inorganic zinc silicate coating, actually reacts with steel to form an inseparable bond with the surface. Because of this interaction, RUST-BAN 190 affords excellent adhesion to give you a hard, abrasion-resistant coating that lasts for years. • Underfilm corrosion is eliminated. Scraping or impacts cannot break the coating to cause failures. • And RUST-BAN 190 contains no lead, is non-toxic and non-flammable. • For complete information, call your Humble salesman or contact Humble Oil & Refining Company, Houston, Texas.

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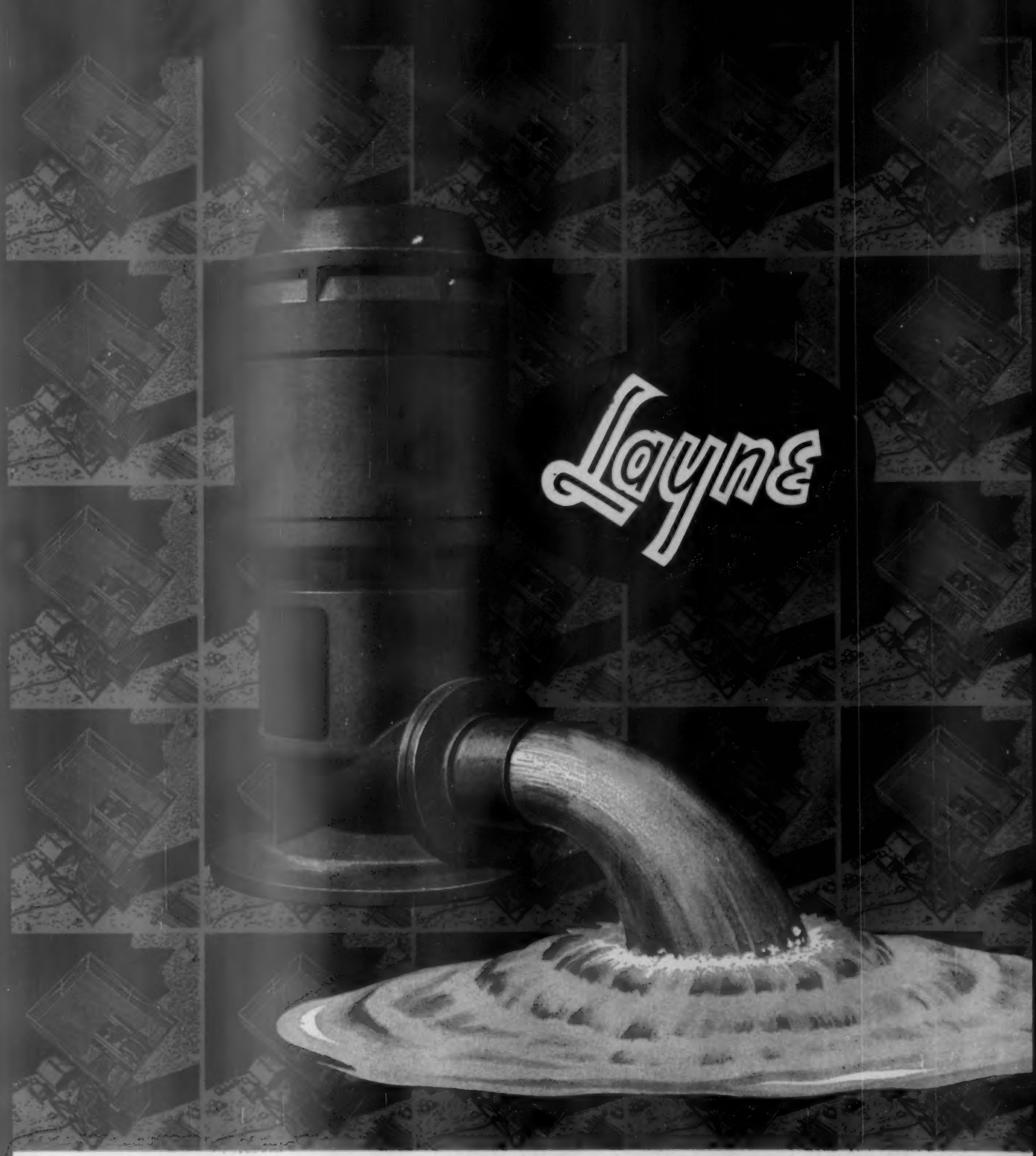

Layne pumps top more producing water wells

Layne Pump Design, manufacture and installation are only part of the complete water service offered by the Layne organization. Other services include: Initial surveys, explorations, recommendations, site selection, foundation and soil sampling, well drilling, well casings and screens, gravel wall wells, construction of water systems, complete research staff and facilities, maintenance and service, chemical treatment of water wells, water treatment. *Write for Bulletin No. 100.*

WORLD'S LARGEST Layne WATER DEVELOPERS

LAYNE & BOWLER, INC., MEMPHIS

Offices and Factory • Memphis 8, Tennessee

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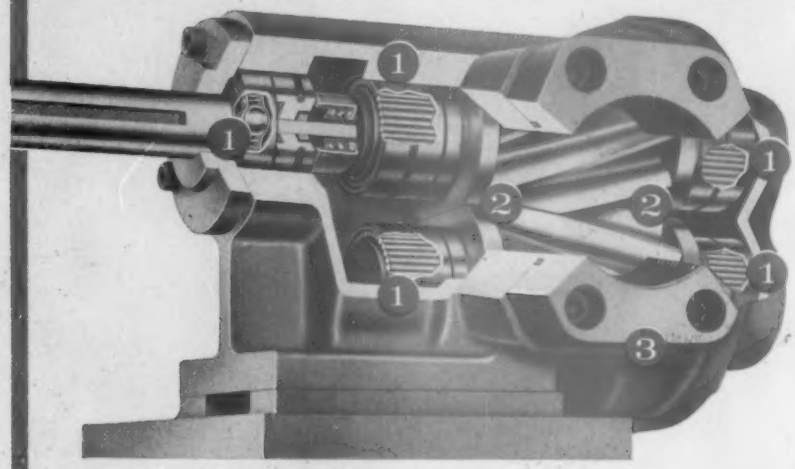
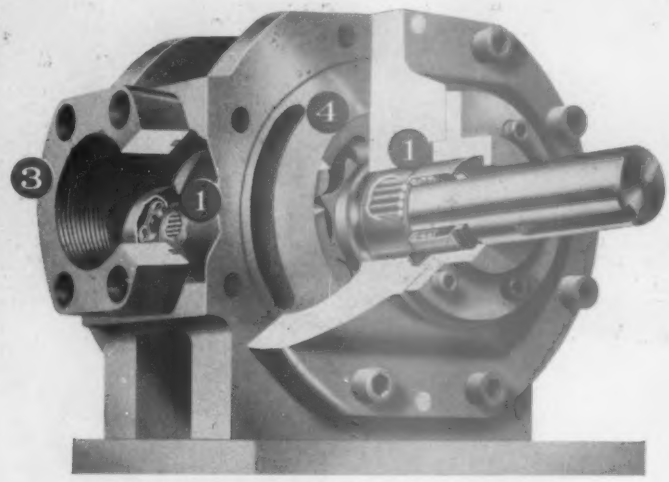
Now from Brown & Sharpe . . .

New rotary pumps with extra long life - built for the Petroleum Industry



New B&S "300" series rotary gear pumps. For pressures to 300 psi; caps. of 40, 60, 90, 125, 175 gpm.



New B&S "700" series gerotor pumps. For pressures to 1000 psi; caps. of 20, 30, 40, 60, 80 gpm.

1. Heavy duty, needle-type antifriction main bearings for radial loads and ball thrust bearings for axial loads in all pumps.

2. Replaceable wear plates prolong pump life. You replace plates after normal wear, not pumps.

3. Available with plain or threaded pipe flanges which can be quickly changed by removing flange screws. Removable flanges eliminate pump replacements caused by damaged welds or threads. Pumps can also be removed easily from the line, without disturbing piping.

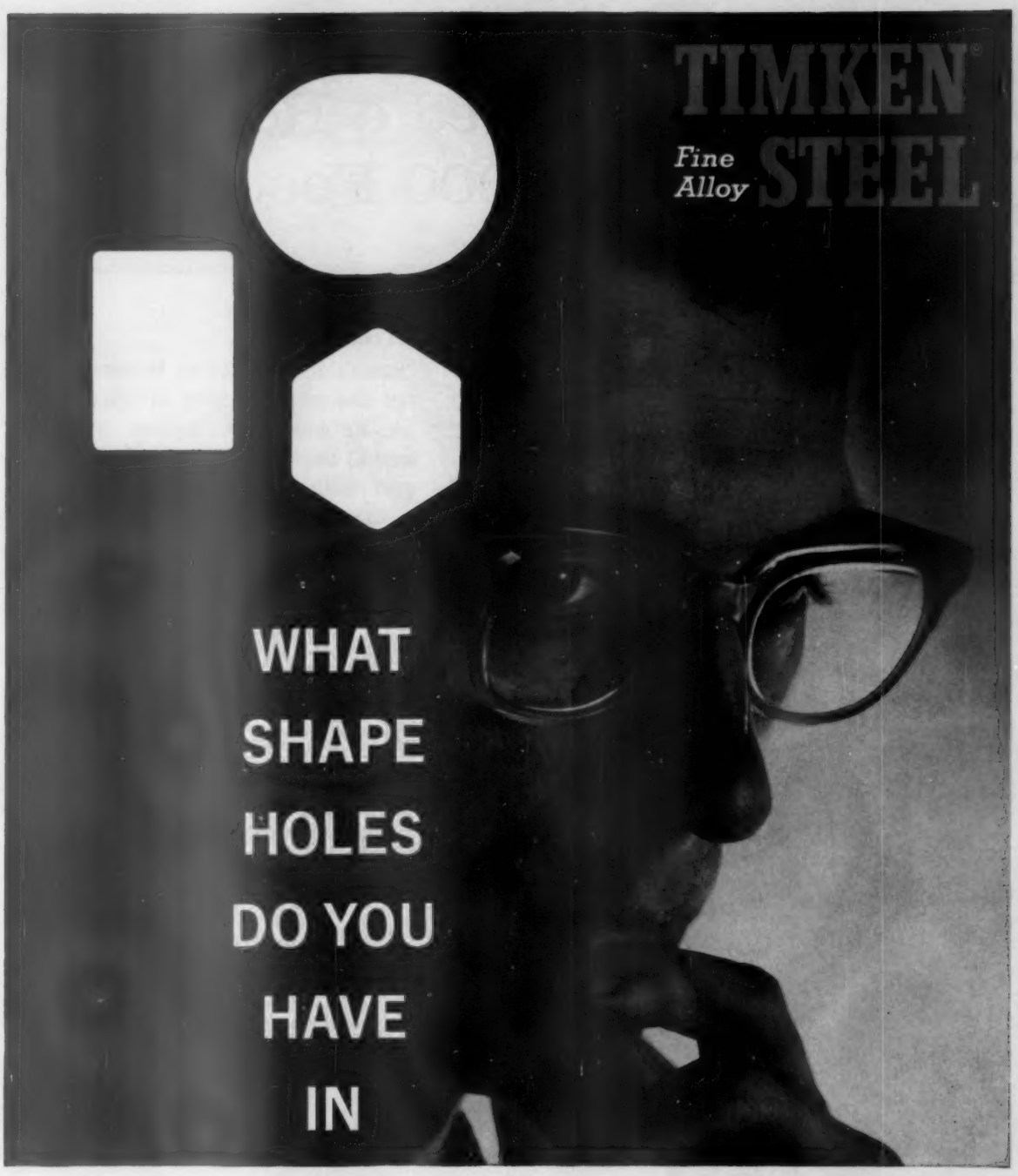
4. Unique gerotor design gives exceptionally long life to the Brown & Sharpe "700" series gerotor pump. Rolling contact between the inner and outer elements progresses at a relative speed only ⅙ that of driven speed.

You save on installation and maintenance, too

These new Brown & Sharpe Pumps have been designed and perfected specifically for the Petroleum Industry, to save you money right down the line. Start saving now.

Contact your oil field supply house about new Brown & Sharpe pumps. Ask them for a catalog, or write: Hydraulics Div., Brown & Sharpe Mfg. Co., Providence 1, R. I.

Brown & Sharpe PRECISION CENTER



No matter. Whether you need a round hole, a square hole or a hex hole for the hollow parts you manufacture, you can eliminate costly machining operations. Start with Timken® seamless steel mechanical tubing and your first step will be finish grinding.

With a special cold working operation, the Timken Company can supply you a variety of shapes and sizes of high quality alloy steel in all common analyses. You get extra strength from the forged quality and spiral grain flow of rotary pierced tubing. And because we target the process to *your* end use, you're assured superior quality and uniformity in your products.

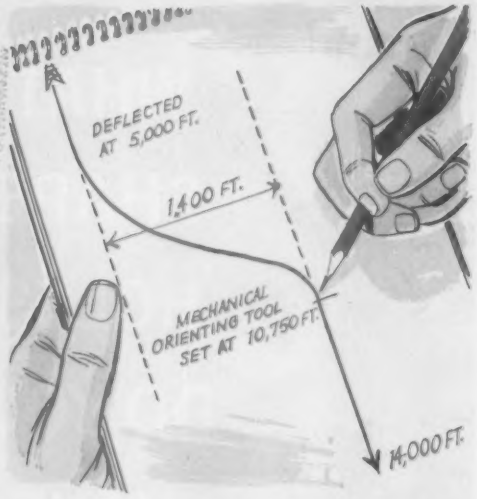
For more information on how Timken seamless steel tubing can save you time and money in all your hollow parts, write: The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.

ANOTHER HOMCO
DIRECTIONAL DRILLING
SUCCESS REPORT

Need a Road Map 14,000 Feet Down?

Gulf Coast Operator reports:

"Homco's Slim Hole Survey Instrument was a real time and money saver on this directional job. We dropped this "Go-Devil" type instrument 63 times, from 10,000 to 14,000 feet with good results."



1. On this hole we had to go straight down to 5,000 feet, then offset 1,400 feet and hit our target area at 10,750 feet, then dig a straight hole to 14,000 feet.

NEED THE ANSWER
TO A DIRECTIONAL DRILLING PROBLEM?
HOMCO HAS IT!

HOMCO

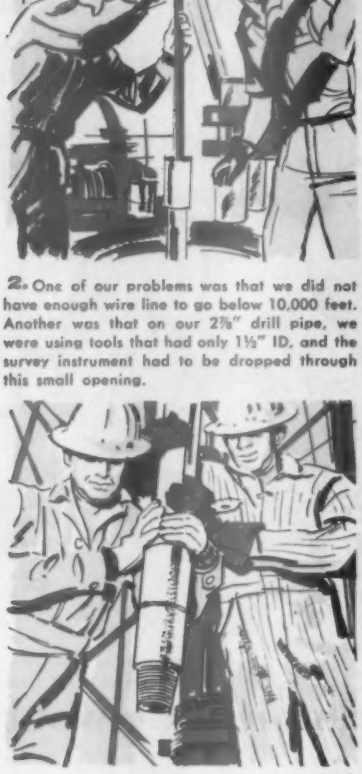
DIRECTIONAL DRILLING

HOMCO ALSO OFFERS

Electrical Well Services | Fishing & Cutting | Oil Field Rentals | Complete Supply Service

2. One of our problems was that we did not have enough wire line to go below 10,000 feet. Another was that on our 2⅞" drill pipe, we were using tools that had only 1½" ID, and the survey instrument had to be dropped through this small opening.

3. We used the Homco Slim Hole Survey Instrument 33 times to successfully reach TD. After reaching TD of 14,000 feet, a fishing job was encountered.



4. We plugged back to 10,500 feet and, using a Homco Mechanical Orienting Tool and a Homco Deflecting Tool, sidetracked the hole.

5. We used the Homco Slim Hole Survey Instrument successfully another 30 times to TD.

HOMCO "HK" SUBSURFACE DIRECTIONAL SURVEY INSTRUMENTS

The HOMCO "HK" Angle Compass Units are the only non-friction apparatus available to obtain course deviations from the vertical and the direction in which this deviation was made. This non-friction property of the "HK" units permits greater accuracy than is possible with any other instruments used in the survey of bore holes today.

The Homco "HK" Singleshot

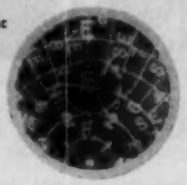
This instrument obtains photographically the information necessary to directionally drill bore holes or to locate bottom, or any part of the bore hole, in relation to the surface. This instrument is applicable to any uncased bore hole over 2¼" in diameter. An inclinometer (only) unit is available for inclination surveys in cased holes.

The HOMCO "HK" instrument may be go-deviled to land in a non-magnetic collar, or to protrude through certain core bits into the open hole. It may also be used on a wire line in the open hole, or to land in a non-magnetic drill collar. It is also frequently used with other tools.

The Homco "HK"-HKS, (slim hole survey instrument)

This instrument is an adaptation of the "HK" SINGLESHOT. The HKS instrument has a protective case that is only 1¼" in diameter and thus can be run in much smaller pipe.

"HKS" Single Shot Disc
(2 times actual size)



The Homco "HK" Go-Devil Multishot

This instrument makes multiple recordings photographically of the information necessary to calculate the deviation of the entire depth of a bore hole. Designed primarily for go-devil operation it may also be lowered on the end of a string of pipe, or lowered into an uncased hole on a wire line.

This instrument uses the same basic principle as the "HK" singleshot. The difference being that the "HK" Multishot makes multiple recordings rather than a single recording on each trip in the hole. A directional survey of the bore hole can be conducted any time it is necessary to remove the drill string from the hole.

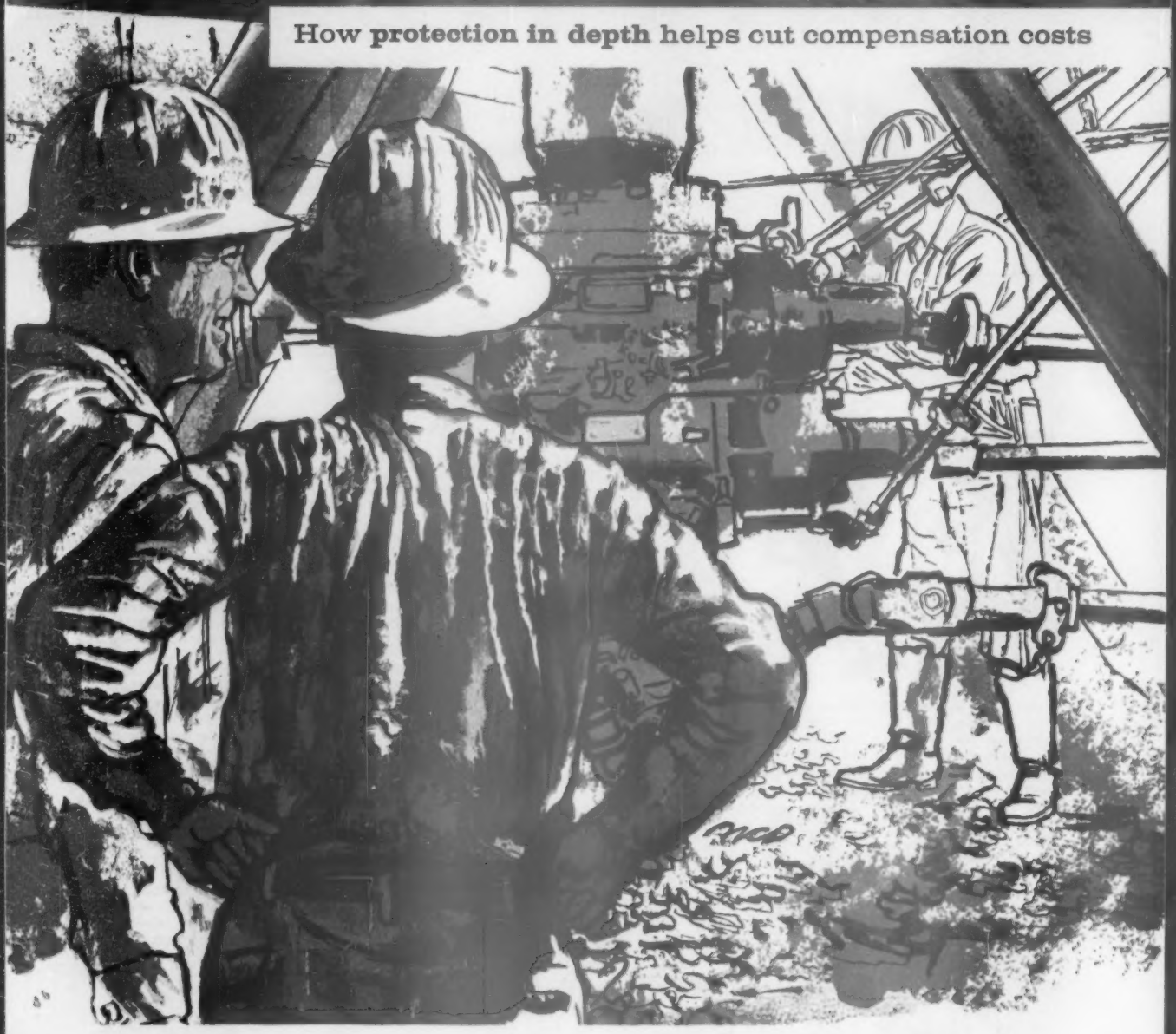
HOMCO

HOUSTON, TEXAS (HEADQUARTERS)

ASSOCIATED A OIL FIELD RENTALS

EXPORT OFFICES
New York, N.Y.
Mexico City, Mexico
Long Beach, California
Maracaibo, Venezuela
Paris, France
Geneva, Switzerland

How protection in depth helps cut compensation costs



How well are your men equipped to handle a blowout?

A well that kicks can be the forerunner to disaster. How swiftly and effectively your crew on tour reacts largely determines the outcome. Are these men trained for a blowout emergency? Liberty Mutual engineers help the pusher and drillers in their training program. They check blowout preventers, fire protection equipment and review the emergency procedures. This thorough check-out is but one of the many Liberty Mutual services that add up to protection in depth. To learn more about Liberty's protection in depth and how it can help lower your business insurance costs, just get in touch with the Liberty Mutual office nearest you.

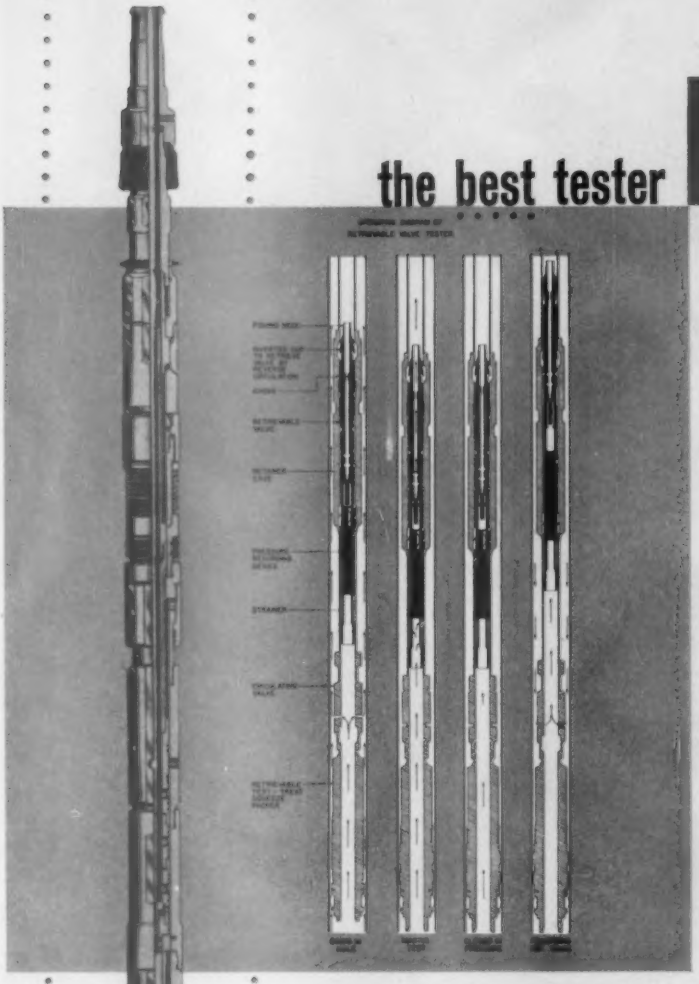
Look for more from **LIBERTY MUTUAL**

...the company that stands by you

LIBERTY MUTUAL INSURANCE COMPANY • LIBERTY MUTUAL FIRE INSURANCE COMPANY
HOME OFFICE: BOSTON

Business Insurance: Workmen's Compensation, Liability, Group Accident and Health, Fire, Fleet, Crime

Personal Insurance: Automobile, Fire, Inland Marine, Burglary, Homeowners



Retrievable Valve Tester

the best tester IN and OUT

...without costly downtime

★ **HALLIBURTON'S RETRIEVABLE VALVE TESTER**

★ **RUN IT IN**
... in its Retainer Case on the tubing string.

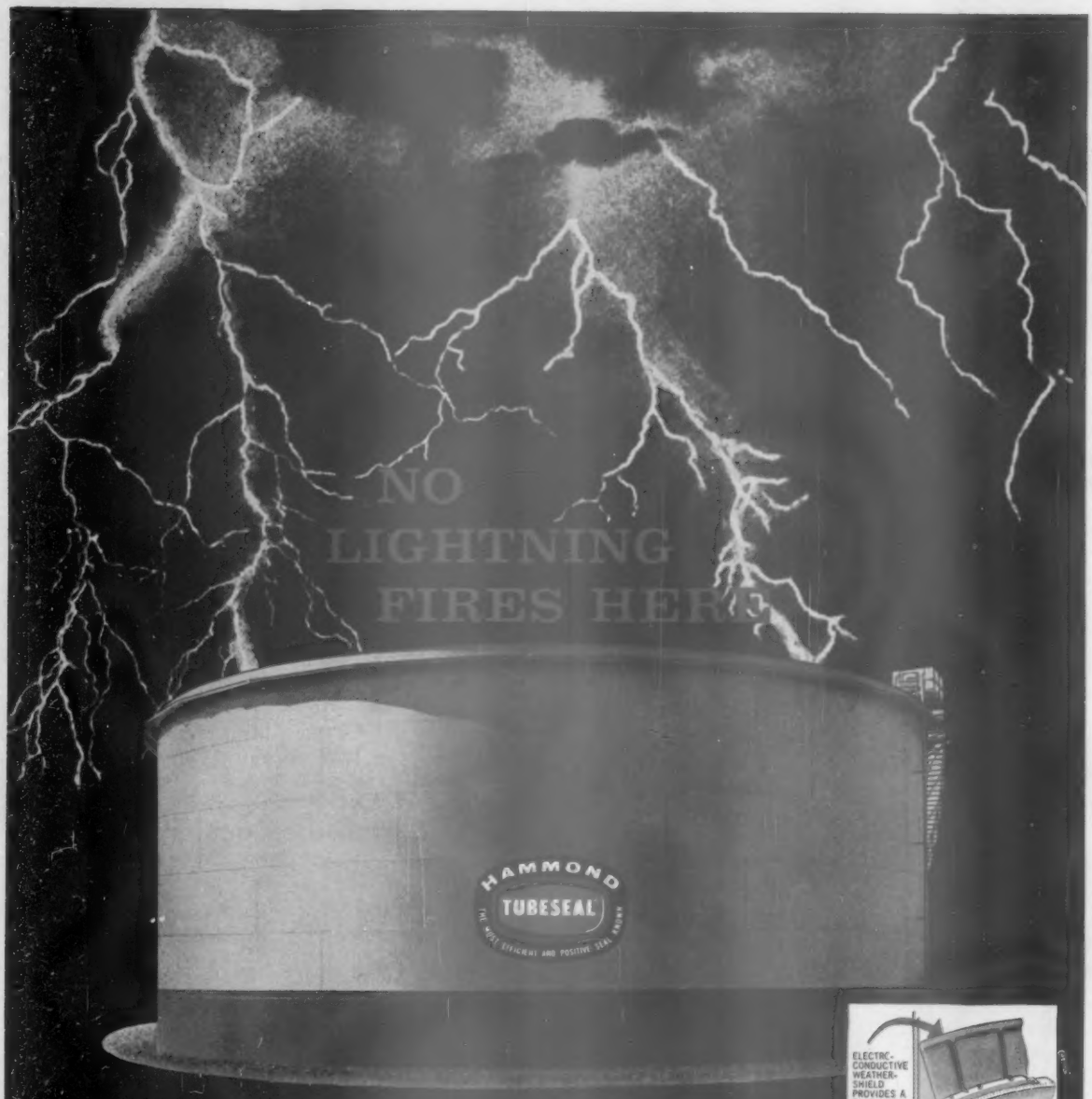
★ **BRING IT OUT**
... with pump pressure ... with a sand line ... or measuring line — *without pulling tubing!*

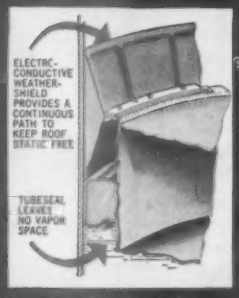
Your Halliburton Operator makes up the Retrievable Valve Tester and Pressure Recording Gauge in the Retainer Case before running in for the test. The tool provides multiple open and closed positions for flow tests and dual closed-in-pressures as desired. The Tester and Gauge can be reversed out, or a retrieving tool can be run in on a wire line to retrieve them from the string without pulling the tubing — or unseating the packer! This leaves a full opening through the string for a fracturing or acidizing treatment to follow immediately. Also, if additional tests are required, the tools may be returned to the Retaining Case on a wire line.

For testing results you can trust ...

TESTING SERVICES

Halliburton
COMPANY • DUNCAN, OKLAHOMA





Tubeseal System Floating Roof Tanks are positively "lightning-*proof*." Not one instance of lightning fire has been experienced in the more than 600 installations throughout the world! ■ Two design features are responsible for this enviable safety record: (1) The patented, electro-conductive weather shield and (2) The elimination of all space where vapors can form. ■ The Tubeseal electro-conductive weather shield provides a *continuous* grounding bond between deck and shell. Static charges just can't concentrate. They are dissipated fully and immediately. And with no vapor to ignite, absolute protection against fire is assured. ■ The Tubeseal Floating Roof can be installed on new or old tanks, of riveted or welded construction. It is the most effective, as well as the safest, conservation system for storing volatile products including *JET FUELS. Send today for Bulletin.*

Pittsburgh-Des Moines Steel Company

PDM

12 plants to serve you coast to coast

PITTSBURGH, WARREN, BRISTOL, PA. • BALTIMORE • BIRMINGHAM • DES MOINES
PROVO, UTAH • CASPER, WYO. • SANTA CLARA, FRESNO, STOCKTON, CALIF.

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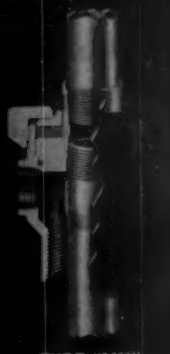
Sales Offices: Atlanta 5 • Baltimore 26 • Boston 10 • Bridgeport 5 • Chicago 3 • Dallas 1 • Denver 2 • Des Moines 8 • El Monte • Fresno • Jacksonville • Los Angeles 57 • Newark 2 • New York 17 • Pittsburgh 25 • Sacramento • Santa Clara • Seattle 1 • Stockton licensees and sales offices in many foreign countries including Argentina, Chile, Australia, Belgium, Brazil, Canada, Colombia, England, France, Haiti, India, Italy, Japan, Mexico, Netherlands, Peru, Puerto Rico, Sweden and W. Germany.

2000 PSI TEST
1000 PSI WORKING PRESSURE

TYPE "SK" SLIP SUSPENSION WITH STRIPPER

TYPE "K" SLIP SUSPENSION



TYPE "MK" MANDREL SUSPENSION

NEW LARKIN "K" TUBING HEADS

here's new economy, safety and efficiency in the 1000 pound range

1. 7⅝" OD 8RD top thread
2. Two 2" integral outlets
3. Hycar packing rings and stripper
4. Suspends tubing 1" through 3"
5. Compact-"SK"is 14½" overall
6. All parts interchangeable

Available . . . "Through Your Supply Store"

LARKIN PACKER COMPANY

DIVISION KOEHRING COMPANY

WAXAHACHIE, TEXAS

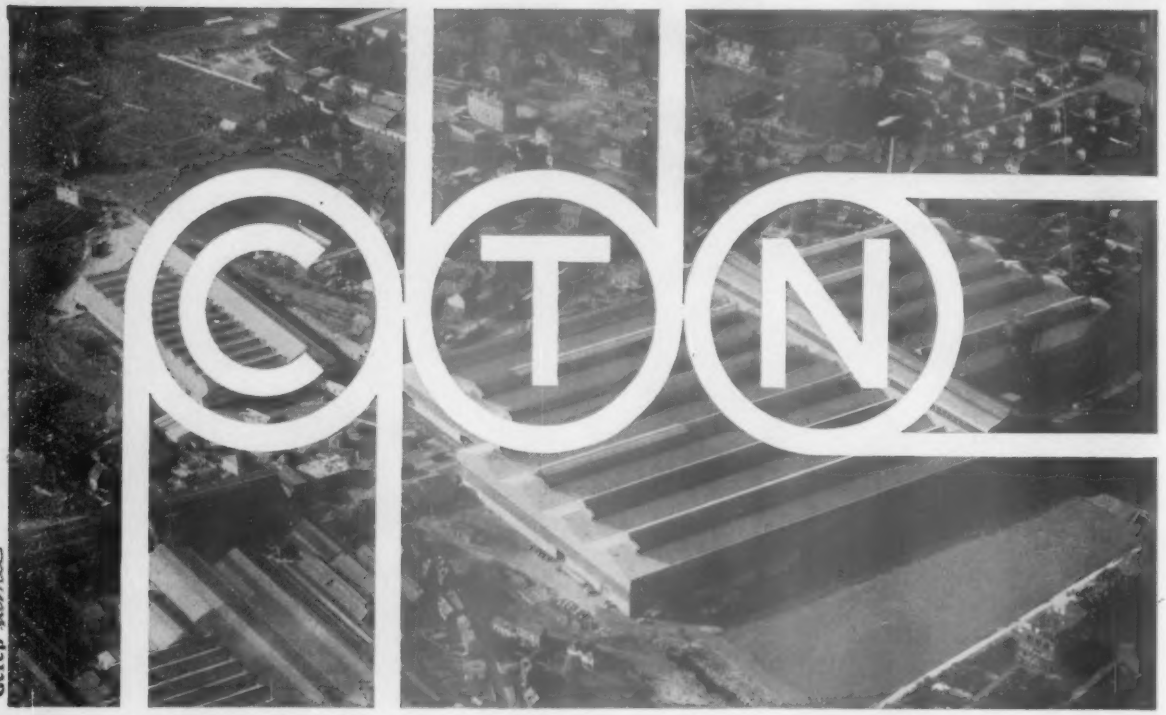
LARKIN

...Through Your Supply Store

LARKIN LEADERSHIP HAS BEEN EARNED BY YEARS OF DEPENDABLE PERFORMANCE

Seamless pipe and tubes

New plant of
Déville-lès-Rouen
Normandie
France



Gercp Hurtrel

Compagnie des Tubes de Normandie

7, rue du Cirque - PARIS 8e (FRANCE)
Tel. BAL. 99-39
Telex : 27.627 COTUNOR Paris
Cable : COMPATUNOR Paris

"Compagnie des Tubes de Normandie" and "The NATIONAL SUPPLY COMPANY" have signed technical assistance agreement ; in addition control and inspection of its total production is supervised by representatives of the "MOODY ENGINEERING CO" on location.

C.T.N. is an AD **licensee**

See : the Composite Catalog of Oil Field Equipment and Services 1960 - 61 pp. 3820 to 3826

Pontex pipe Corporation

Suite 1317 116 John street N. Y. C.
NEW YORK / U. S. A.
Phone : WORTH 20.976
Correspondent of
Compagnie Pont-à-Mousson and affiliates

PONT-A-MOUSSON
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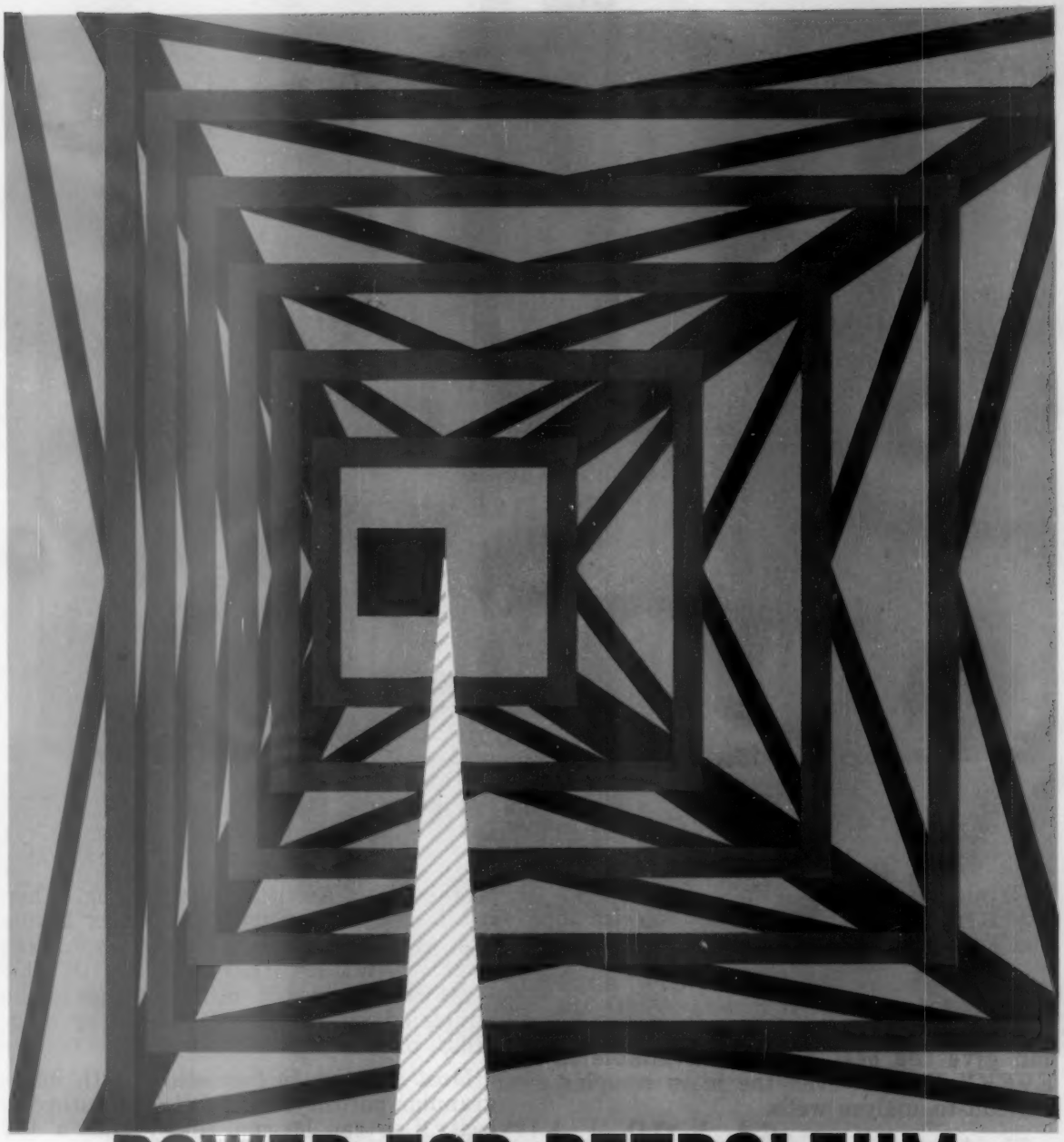


POWER FOR PETROLEUM

Portability plus dependability, long life and low-operating costs are key reasons why petroleum people specify Cummins Diesels. With Cummins you get power for any oil field need from a 700 h.p. diesel electric drilling unit to a 70 h.p. washdown pump. Finally, wherever you operate in the world, you will find Cummins Sales and Service—more than 700 locations—nearby. **Cummins Engine Company, Inc., Columbus, Indiana.**

CUMMINS

A COMPLETE PACKAGE

Development of Welex's Acoustic Velocity Log adds a sparkling new service to the Welex Simplified Logging Program.

Formerly effective in 90 percent of today's wells,Welex's Simplified Program, with the addition of the Acoustic Velocity Log, now can give the best answers available in EVERY WELL—even the more complex, difficult-to-analyze wells.

The Acoustic Velocity Log accurately determines porosity by measuring the velocity of sound traversing formations. It also is useful to geophysicists for interpretation of seismic records.

As with the Welex FoRxo and Neutron Logs, porosity values can be read directly off the Welex Acoustic Velocity Log. When run in conjunction with the Welex Induction or Guard Log, the most important question—WILL THE WELL PRODUCE?—can be answered in minutes by use of the Simplified Interpretation Charts, or "pigtails," printed right on the log.

Most effective in formations with intergranular porosity, the Welex Acoustic Velocity Log can be run jointly with a self potential curve, gamma ray curve or caliper log for correlation purposes.

Next time and every time call your nearest Welex representative for the complete package of logging services that will answer the most important question—WILL THE WELL PRODUCE?

ORIGINATORS OF THE PERFORATING
Welex

WELEX, INC.

General Offices: 1400 East Berry, Fort Worth, Texas
In Canada: Welex of Canada, Ltd.

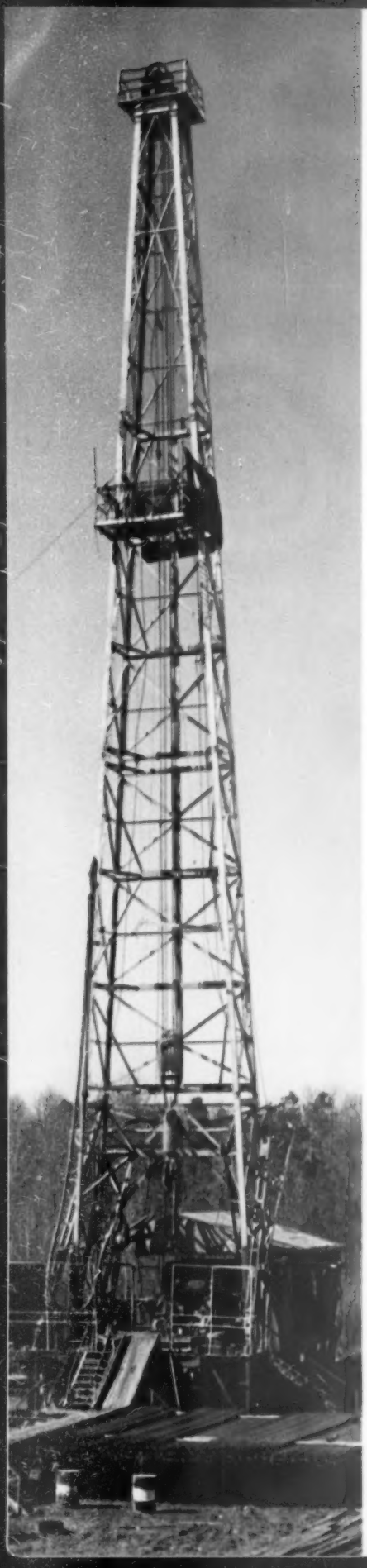
New 2 1/16" OD SPANG tubing installed in multiple completion East Texas well.

Now! Spang has 2 1/16" OD tubing for multiple completion wells

THE NATIONAL NSCO SUPPLY COMPANY

Spang has expanded its line of oil well tubing to include 2 1/16" OD tubing. The new, small size is ideal for dual and multiple completion wells. Spang's tubular capacities are constantly being revised in this manner to keep ahead of your requirements for tubing, casing and drill pipe. You'll find it pays to standardize on these Spang products.

More about Spang tubing on next pages:

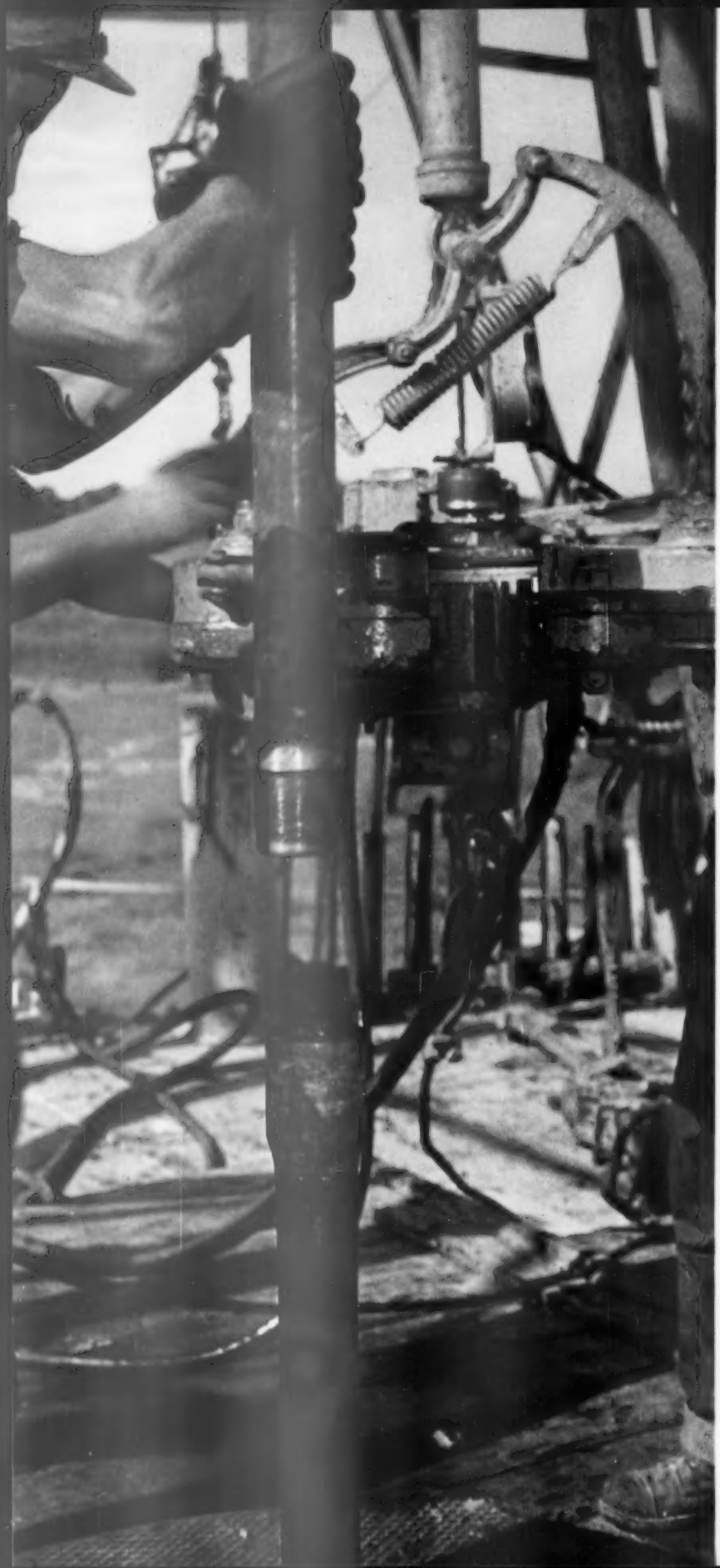


New tubing size meets needs of Multiple Completion Wells

Reports from field users verify successful performance of Spang's new, small size tubing in multiple completion wells. The 2 1/16" OD tubing is now available with integral joint (upset) and threaded and coupled joint (non-upset). Respective nominal weights are 3.25 and 3.20 pounds per foot. Both types are supplied in grades J-55 and N-80. Your nearby National Supply representative has complete details. Call him soon.

This integral joint Spang tubing is readily available in grades J-55 and N-80. Tubing is always delivered in factory-perfect condition.

◀ Spang's new leak-resistant 2 1/16" OD tubing was specified for this East Texas multiple completion well.



Streamlined SPANG Extreme Line tubing guarantees positive resistance to leakage

Integral design of Spang Extreme Line tubing results in a sealed joint that is always shoulder tight. Unique metal-to-metal seal resists leakage in the deepest, high pressure wells.

Extreme Line joints are streamlined internally and externally, minimizing possibility of hanging up or stripping under pressure. Integral joint eliminates 50% of the connecting threads in conventional designs.

Wide, heavy, modified Acme threads speed joint make-up with minimum chance of cross-threading.

Spang Extreme Line tubing is available in grades J-55, N-80 and P-105 to meet your toughest well conditions. It rounds out Spang's complete line of tubing for specific applications. Your National Supply representative always can recommend the exact Spang tubing that suits your requirements. Or write for new bulletin covering complete details.

Fast make-up is a sure thing with Spang Extreme Line tubing. Couplings are eliminated. Rugged joint permits repeated make-up and breaking out without galling.

Steel

Steel's Symbol of strength, long life, and economy

Spang CW steel pipe has wide application in gas, oil and water gathering lines.
User reports are unanimously enthusiastic about Spang pipe quality.

Superiority of SPANG CW steel pipe is due to many things . . .

UNIFORMITY Every length is manufactured under identical, closest possible quality controls on Spang's efficient production equipment.

TESTS AND INSPECTIONS All Spang pipe is thoroughly inspected and hydrostatically tested for strength. Each length is easy to cut, bend, thread and weld.

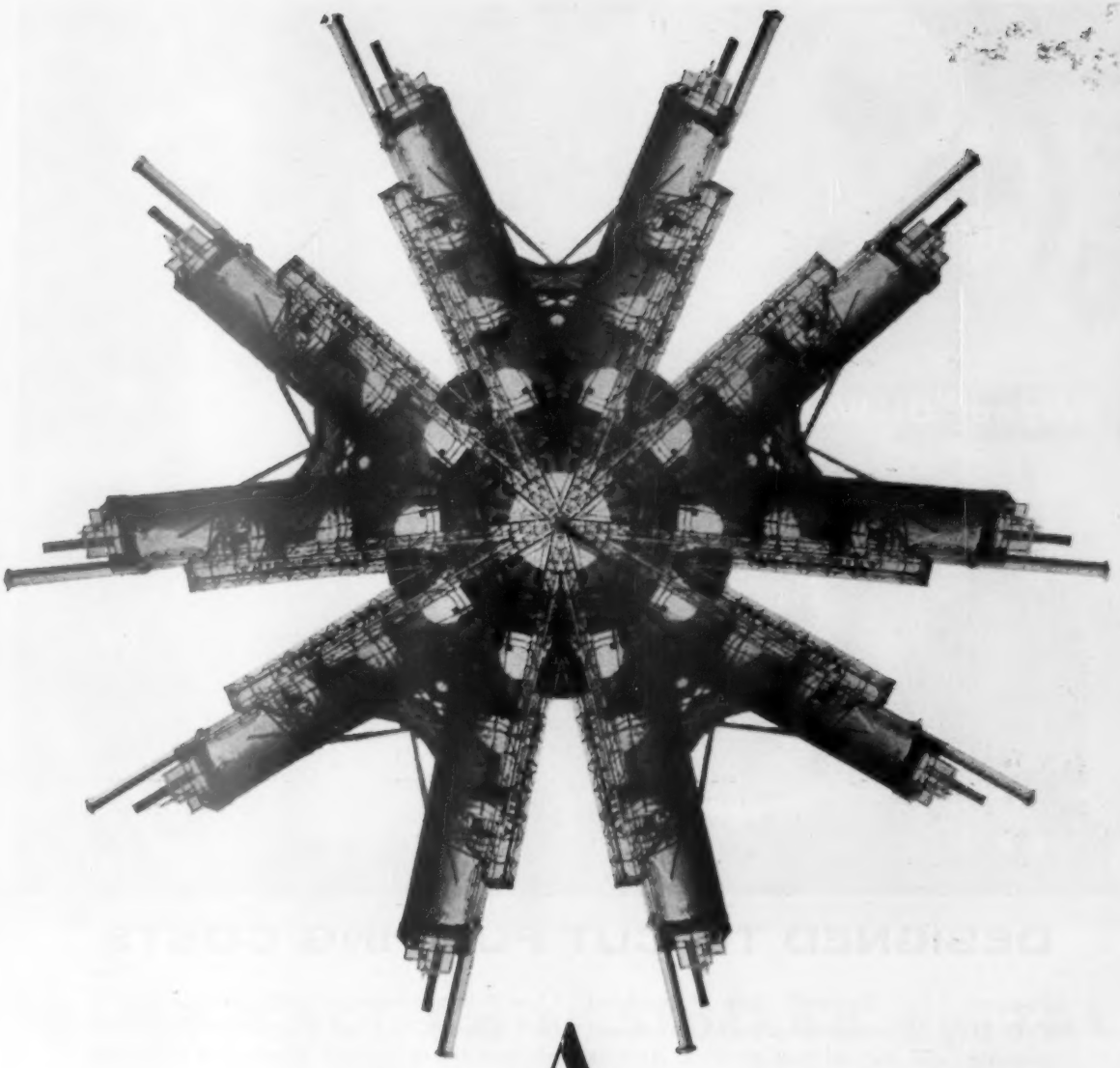
AVAILABILITY National Supply has the manufacturing and distribution facilities to assure availability of all pipe sizes—plain end or threaded and coupled—*when* you need them.

These are only a few of the reasons for the superiority of Spang CW pipe. And you get this special pipe quality without premium price. Call today for prompt delivery.

THE NATIONAL SUPPLY COMPANY
Two Gateway Center, Pittsburgh 22, Pennsylvania
Subsidiary of Armco Steel Corporation

DIVISION OFFICES: Calgary, Columbus, Dallas, Denver, Houston, Torrance, Tulsa
EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E.C. 1

Litho in U.S.A.

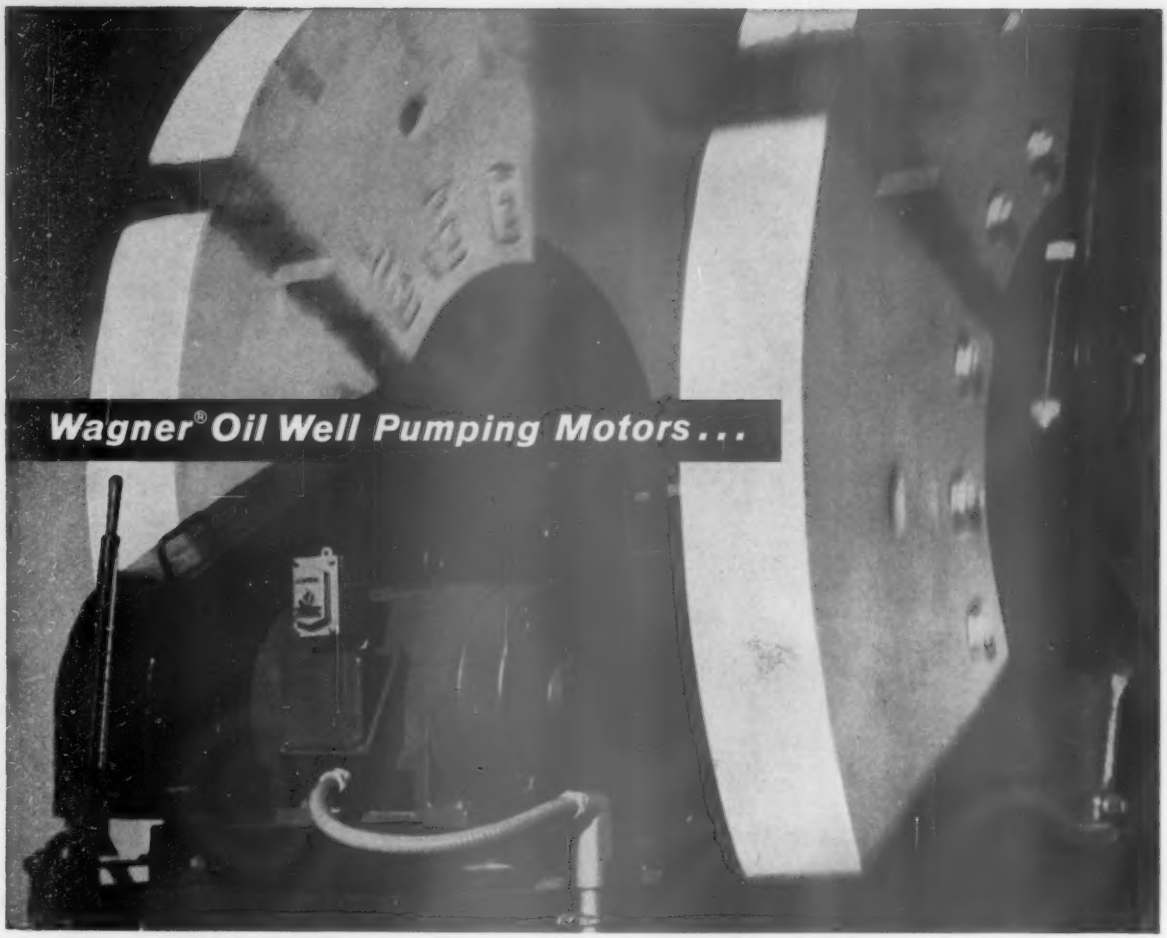


Always the perfect fit

Regardless of your requirements, there is a Davison cracking catalyst to fit your refining picture: 25% Alumina for highest activity maintenance — 13% Alumina for low cost octanes — Semi-Synthetic S-S for economical control of selectivity — Silica-Magnesia for maximum middle distillates. Nearly three-fourths of the refiners in the Western Hemisphere rely on Davison for superior catalysts and superior services. Contact our local field representative, or write Dept. A-011 today.

This unique kaleidoscopic photo technique is the experimental work of Cal and Don Young, Philadelphia, from a black and white photo by the Adams Studio, Odessa, Texas

DEPARTMENT A-011
W.R. GRACE & CO.
DAVISON CHEMICAL DIVISION
BALTIMORE 3, MARYLAND



DESIGNED TO CUT PUMPING COSTS

Positively. For Wagner® Class B insulated Type DP-6 Motors are engineered for oil well pumping, *and only oil well pumping.* Nothing else. Because they are designed with high torque and high slip for this specific job, these motors consume fewer kilowatts per barrel pumped . . . give you double dollar savings (in initial investment and in operating costs) without sacrificing efficiency and dependability.

Consider this: built in ratings of 5 hp and larger, these high torque motors handle heavy initial loads smoothly and without laboring or stalling. Their high slip feature lets them slow down at peak load so the flywheel of the pump can deliver part of its stored energy to the load. Motor windings are protected by advanced Class B insulation which provides ample thermal capacity to absorb heat resulting from peaks of the cyclic load. Completely dripproof enclosures protect them against rain, sand, sleet and snow. Rugged cast iron frames and endplates bar corrosion. Conduit boxes are moisture-proof and dust-tight, and ventilating openings are screened to keep out animals and wind-blown debris. You pump *better* electrically with Wagner Motors.

Your Wagner field engineer can give you the complete story, and help you plan oil well pumping, gathering and water-flooding systems . . . assist you in solving your electrical problems. Call him now, or write for Bulletins MU-243 and MU-246.

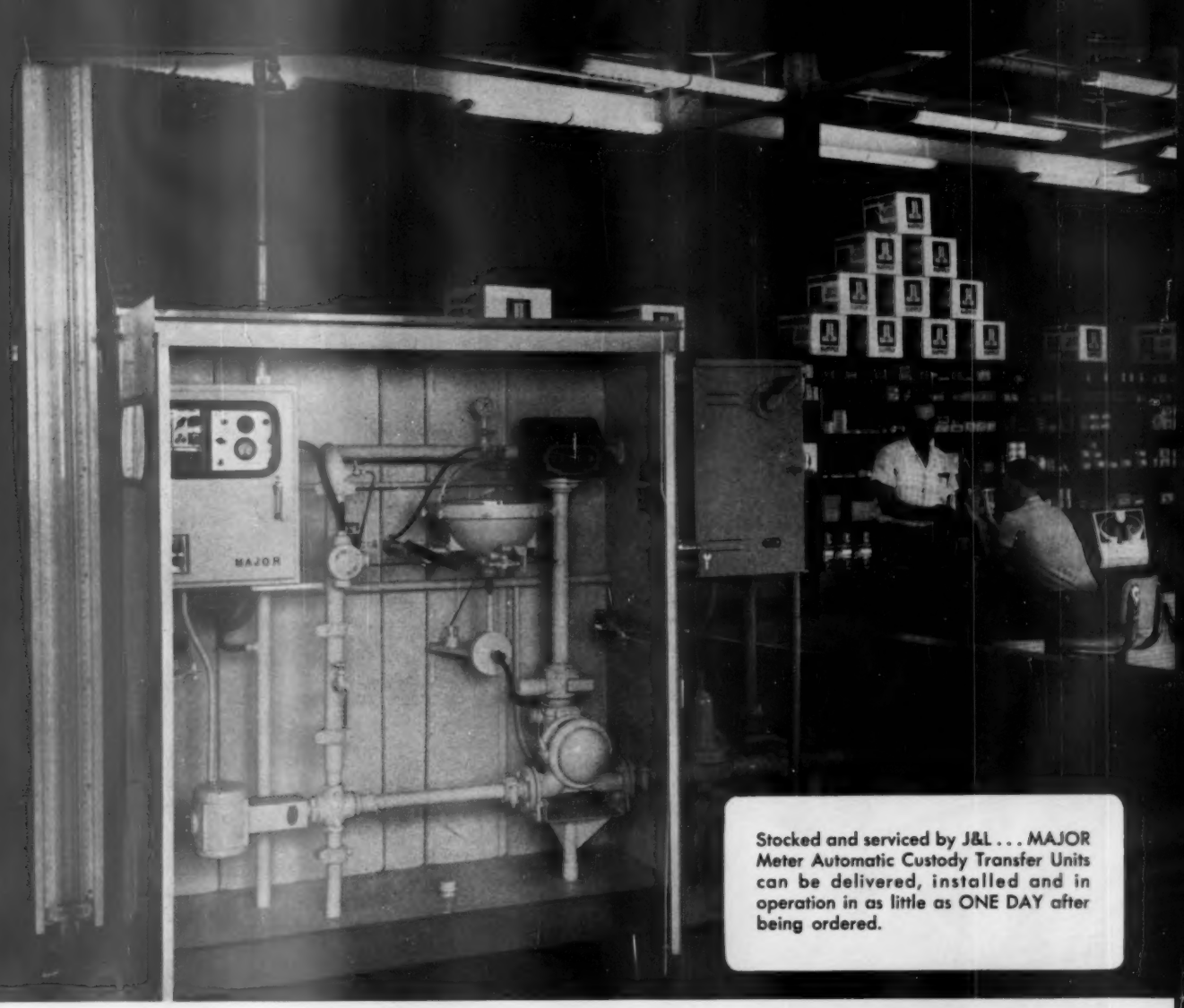
BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation

6389 PLYMOUTH AVENUE • ST. LOUIS 33, MISSOURI

WH60-22

SERVING 2 GREAT GROWTH INDUSTRIES—*ELECTRICAL • AUTOMOTIVE*



Stocked and serviced by J&L . . . MAJOR Meter Automatic Custody Transfer Units can be delivered, installed and in operation in as little as ONE DAY after being ordered.

MAJOR ENGINEERING COMPANY TULSA MACT Units Stocked by J&L

MAJOR standard packaged units, all electric, are available in 7 sizes, from 200 to 20,000 barrels per day. Major's smallest unit, the "700", is shown above.

The MAJOR unit progressed from the experimental, testing phase two years ago. It has proved satisfactory to users in measuring millions of barrels of crude oil. Standardization, mass production, and stocking are now practical.

Dependability — describes MAJOR MACT units. And dependability can result only from perfected design based on actual field operation, quality components, and complete factory testing before shipment. Ask your J&L man for literature, or write us at Tulsa — Drawer 2481.

FEATURES: ALL ELECTRIC — No instrument gas required. COMPLETELY PACKAGED — Only four pipe connections to make in the field. COMPLETELY WIRED — No field wiring except connecting electric power. INTEGRAL FOUNDATION — Skid base light weight concrete filled. HOUSING — All precision components protected by rugged 14-gage housing with door handle lock. REPAIR CONVENIENCE — All control panel components plug in, are hermetically sealed. Standard trade-in charge for certain wearing components. STANDARDIZATION — Components and repair parts carried in stock.

MAJOR ENGINEERING COMPANY TULSA

Jones & Laughlin

SUPPLY DIVISION - Tulsa

If it's sold by J&L . . . .
It's the best available

DE LAVAL

CENTRIFUGAL COMPRESSORS

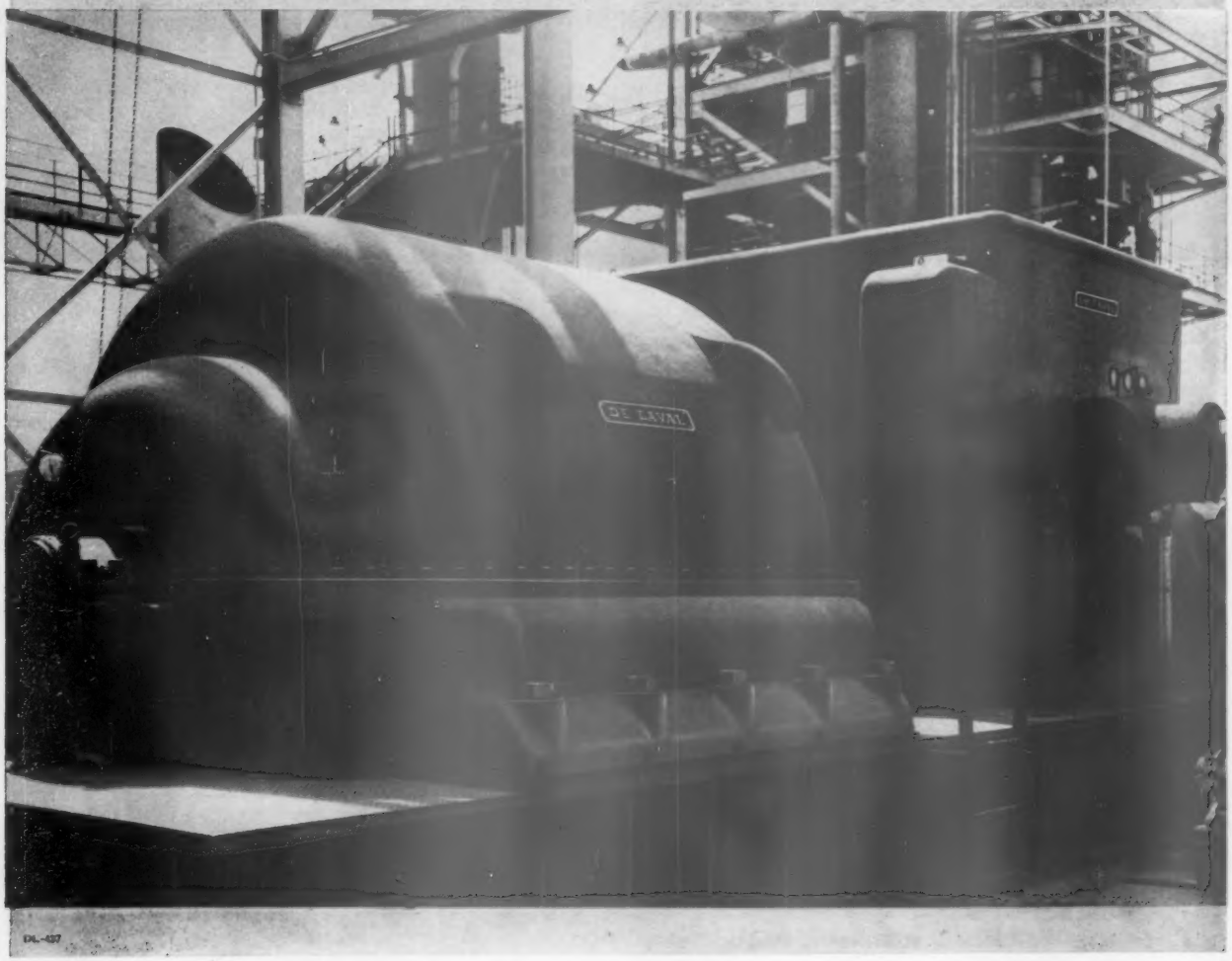
11,300

Driven by automatic extraction steam turbine

Shown below is the large 11,300 horsepower centrifugal blower which compresses air for the main blower service in catalyst regeneration at Standard Oil of Ohio's new refinery at Toledo, Ohio.

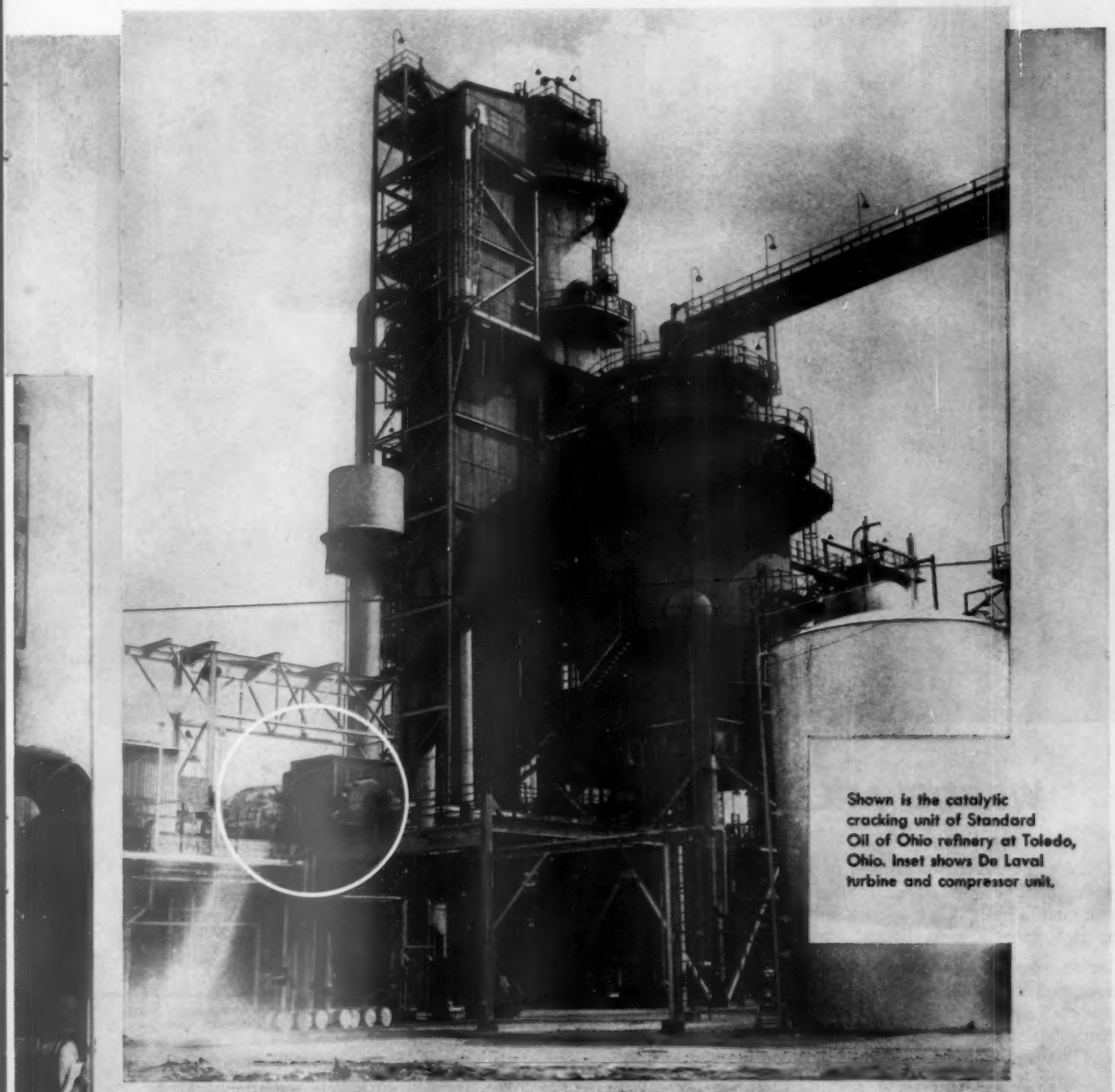
Driven by a De Laval single automatic extraction steam turbine, it compresses 110,300 cfm in four stages at 2800 rpm. Inlet pressure is 14.7 psia and discharge pressure is 40.7 psia. The turbine is designed for 600 psig ISP, 740F extracting at [illegible] psig, and exhausting to 28" Hg.

This is another example of De Laval proved performance.



DL-437

horsepower DE LAVAL compressor for "cat cracker" at SOHIO refinery



Shown is the catalytic cracking unit of Standard Oil of Ohio refinery at Toledo, Ohio. Inset shows De Laval turbine and compressor unit.

DE LAVAL *Steam Turbine Company*

810 NOTTINGHAM WAY, TRENTON 2, N. J.

DOW | WEED AND GRASS KILLERS

WEEDS ARE A HAZARD YOU CAN'T AFFORD

If you can't afford the hazard of fire near your storage tanks, pipelines, or valves . . . then you can't afford to be without Garlon*, the low-cost, easy-to-mix product that destroys flammable weeds and grasses.

Garlon, sprayed on the top of weed or grass plants, works through the growing system killing everything from leaves to roots. Applications of Garlon can be made any time weeds are succulent and actively growing. What's more, next season's vegetation control will be easier and less expensive if you start using Garlon this year.

Garlon is easy to use. Your own maintenance crews can do the job faster with far less effort and expense than with regular chopping, cutting or mowing. Or a professional contractor will do it very reasonably. Write: THE DOW CHEMICAL COMPANY, Agricultural Chemicals Sales, Dept. 206DC11-14, Midland, Michigan, for full information or the name of a qualified contractor near you.

Hand-cutting costs stay constant from year to year

Chemical maintenance costs actually diminish each year

See "The Dow Hour of Great Mysteries" on TV.

*TRADEMARK

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

Number 1 of a Series

TELL THIS PETROLEUM INDUSTRY FACT TO YOUR NEIGHBOR

Don't eat the seed corn!

From each year's harvest, a portion must be set aside as seed corn to assure a crop next year. Never sold, never eaten, the seed is the only guarantee against a famine.

The same is true with oil and gas. A new "crop" must be *sought* each year. Percentage depletion, commonly but erroneously called "depletion allowance," provides the seed that finances the search and assures next year's crop of oil. A substantial portion of each year's income must be set aside by the petroleum industry, as seed, to guarantee a continuing supply of oil and gas. This operating principle has made the petroleum industry a leader in free world enterprise.

A nation deprives itself of its own future and penalizes all consumers when it deprives any industry of the seed that guarantees future productive harvests.

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BAROID

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MAIN OFFICE: P. O. BOX 1675, HOUSTON 1, TEXAS

BAROID—*Still Pioneering Drilling Mud Research • Engineering • Marketing*

Reproduction proofs of this message are available. Write Advertising Department, Baroid Division National Lead Company, P. O. Box 1675, Houston 1, Texas. 6099

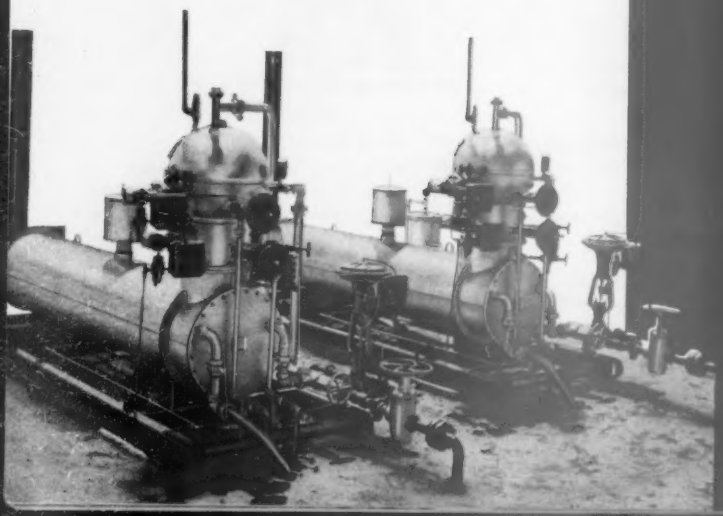
If Cold Weather is Putting the Bite on Lease Production...

BS&B's

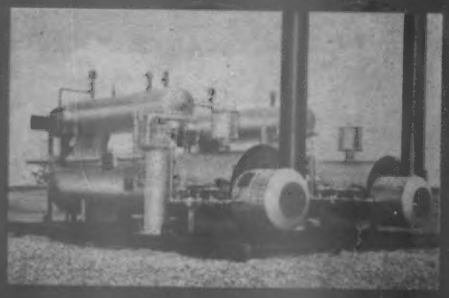
Free-O-F

FREE-O-FREEZ combines a spherical or horizontal separator and an indirect heater in one *automatic, compact, skid-mounted* unit. These units control bottom liquid temperature. BS&B's new Flash Arrestor gives maximum burner safety and eliminates possibility of flash-back. Variations of flow recorded on the gas chart are kept to a minimum by setting oil dump controls on throttling and water dump controls on snap. Snap acting water dump helps prevent freezing.

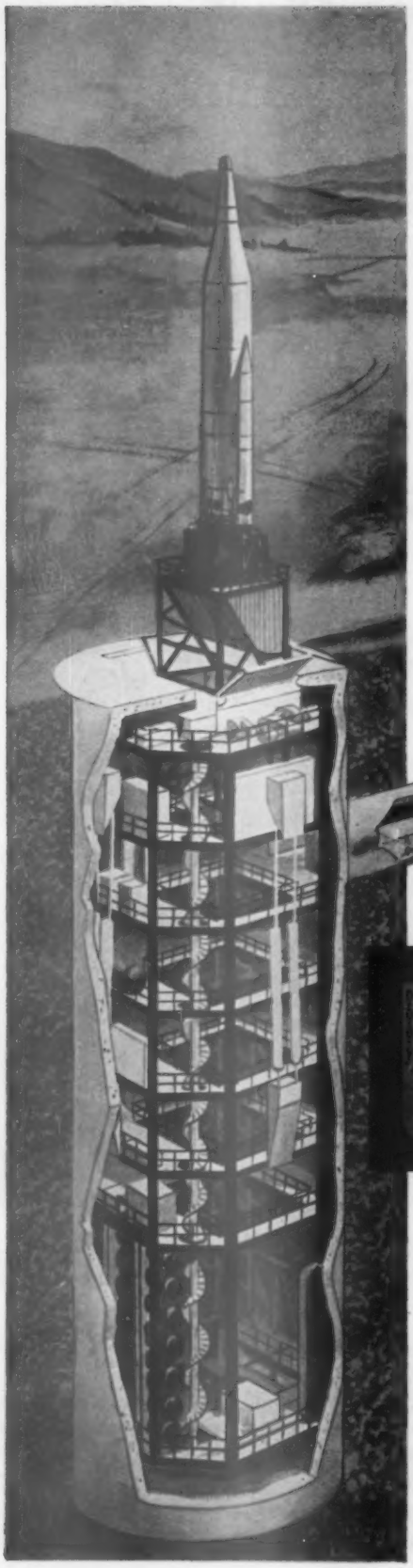
These spherical separator heater units each process 2 to 4 MMSCFD of gas with 18 bbls. of oil and 2 bbls. of water per MM. They have seen two hard winters. There were no freeze-ups. Displacement element for water dump is hung vertically, completely immersed in the liquid section, making for easier control of interface of oil and water. Submerged liquid section has sufficient area to warm the liquid in it, but there is little heat transferrence to upper gas section. Lower liquid is kept warm independent of sales gas temperature. Wellstream is preheated in the heater flow coil before choking to prevent hydrate formation in the separator.



Prevents equipment freeze-ups, shut-downs and service calls

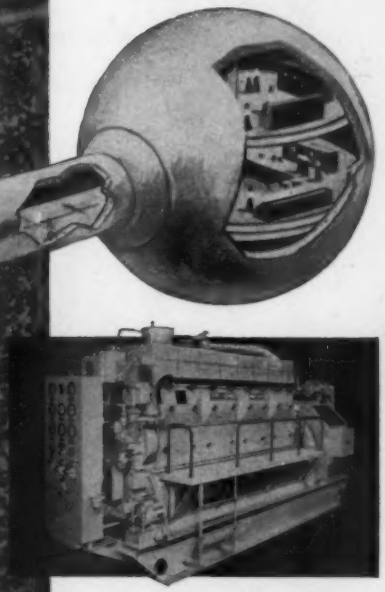


BS&B



WHITE SUPERIOR ENGINES selected for ATLAS launching sites!

At USAF Atlas launching sites throughout the United States, prime and standby power will be supplied by White Superior engines! The Army Corps of Engineers, Kansas City, Missouri, has purchased 149 eight-cylinder supercharged Model 40 Superiors, each driving a 500 KW generator. These engine-generator sets will produce precise frequency for operation of computers and other electronic equipment. Six of the 13 planned Atlas ICBM squadrons will feature underground silo-type launching sites. Here an additional task for the Superiors will be powering elevator machinery to lift the 120-ton ICBM's to ground level, after they have been fueled and checked out down under.



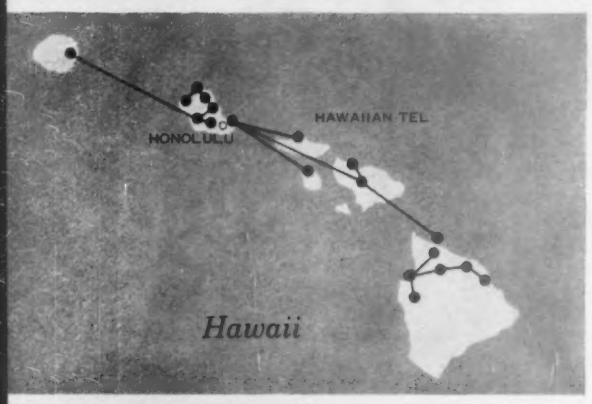
White Diesel

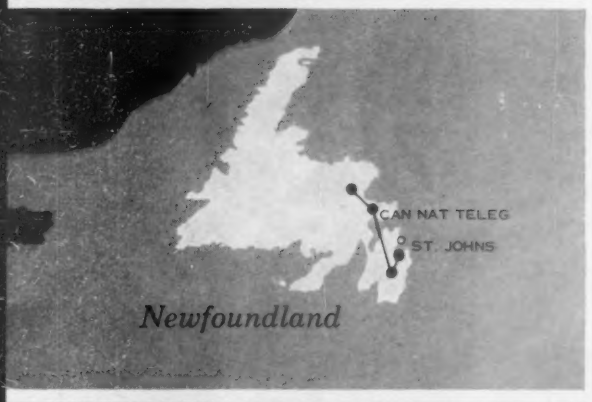
Superior ENGINES · ATLAS Imperial DIESEL ENGINES · White DIESEL

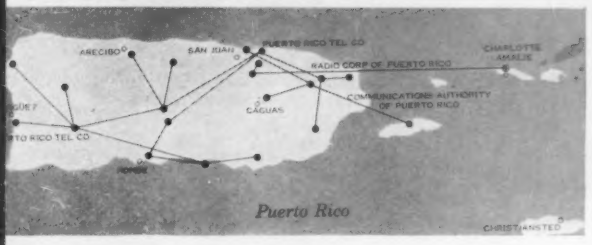
WHITE DIESEL ENGINE DIVISION
THE WHITE MOTOR COMPANY
Plant and General Offices: Springfield, Ohio

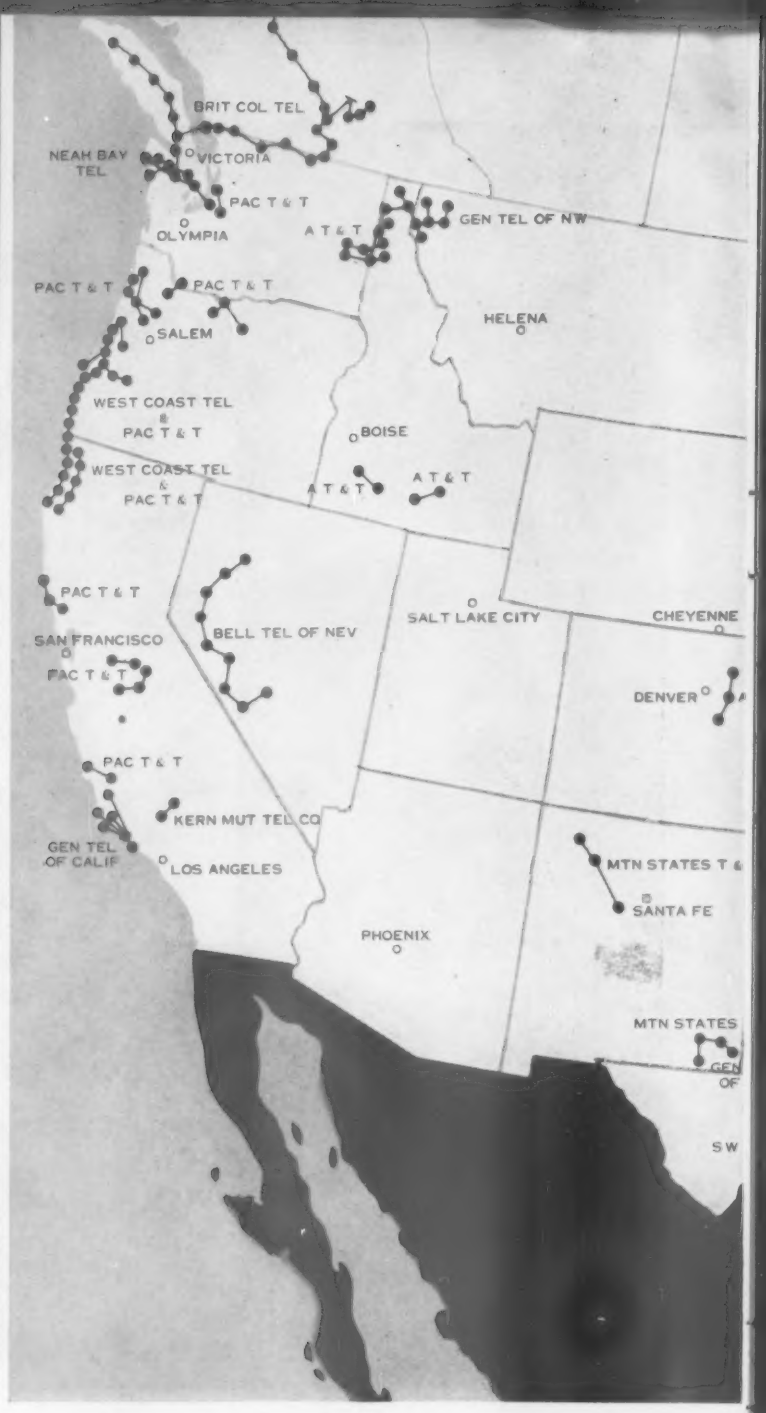
The contract for 149 Superiors highlights a growing and impressive list of Superior-powered U.S. defense installations. Included are the "Texas Towers," portions of "DEW" line and "SAGE" project, Eglin Gulf Test Range and other missile tracking ranges, and numerous launching sites for other types of missiles. Acceptance of Superior engines for these assignments is convincing evidence of their rugged dependability, trouble-free performance and economical fuel consumption. Superior engines—215 to 2150 HP or 150 to 1500 KW—will also meet your exact power requirements, including automatic, unattended or remote controlled operation. Write for complete information today!

USAF artist's conception of Atlas underground silo for launching missiles









Why so many *Lenkurt* microwave systems

First, Lenkurt's Microtel microwave system offers *as standard equipment* many features that are considered "extras" for other systems. For example, Microtel has *automatic* frequency control that assures you maximum frequency stability.

Second, Microtel's superior, constant-output klystron (warranted to 5,000 hours) requires no temperature-compensating oven. Since the tube operates at lower

are springing up across the country

temperatures, life expectancy is greatly increased. Field experience with Lenkurt Microtel indicates that klystron life will average at least 15,000 to 18,000 hours.

Before you spend one penny for carrier or microwave, let our staff engineers help you in system planning. These men are specialists in helping you make fullest and most profitable use of existing facilities . . . and you are assured of equipment recommendations tailored to your needs.

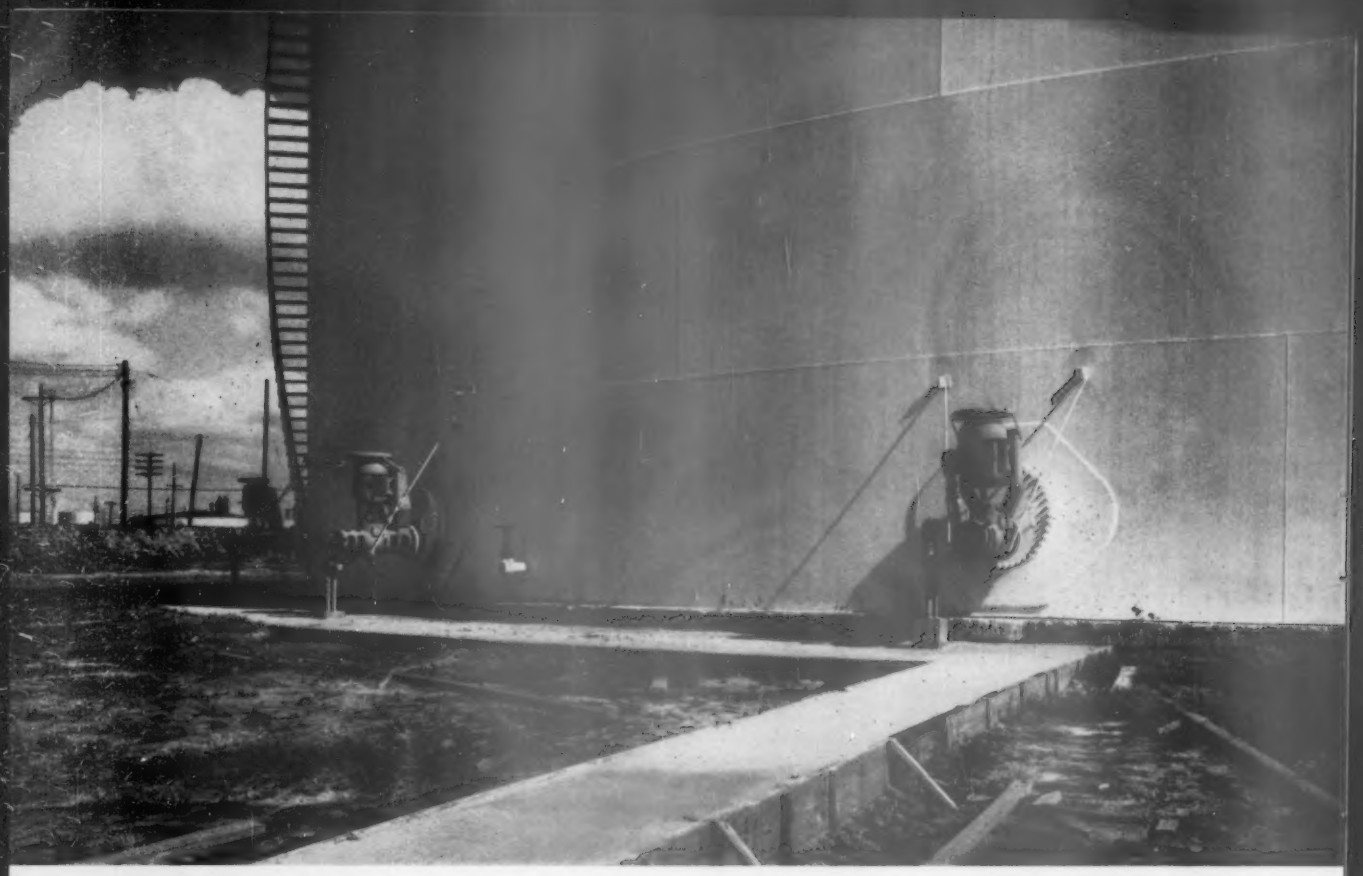
For full details on Lenkurt microwave or for help in system planning, call your nearest Automatic Electric representative, or the Director, Petroleum Industry Sales, Automatic Electric Sales Corporation, Northlake, Illinois.

AUTOMATIC ELECTRIC

Subsidiary of

GENERAL TELEPHONE & ELECTRONICS

GENERAL SYSTEM



How they keep crude from **stacking up like pancakes**

Surging into this tank come crudes from wells scattered over 23 counties.

Out of the tank comes *one* crude, at the right gravity to feed to refineries more than 450 miles away.

For the men who run the tank farm, it's no chore at all to blend 122,000 barrels of crudes ranging from less than 20° to above 85° in gravity. They do it by flipping three switches.

The LIGHTNIN Mixers you see here do the rest. While the tank is filling, and for two or three hours before it goes on suction, the mixers create a powerful, steady turnover that breaks up stratification from the bottom up. The outgoing tender of crude stays within a degree or two of constant gravity.

Control BS&W, too. That's not all. These mixers help keep sludge from settling on the tank bottom and stealing valuable storage space. They keep the tank working at its full capacity.

Multiply these savings by the number of tanks at this farm equipped with LIGHTNIN Mixers—and you can see why more than 50 pipeline companies and 35 leading oil companies use this easy way to keep operating costs in line.

How about you? If you'd like to see how LIGHTNIN Mixers on your big tanks can save you as much as $1000 per tank per year, call in your LIGHTNIN representative. He's listed in Composite Catalog. Or write us today.

YOU CAN ADD as much as 12% extra storage capacity to your tank farm—by using LIGHTNIN Mixers to keep tanks free of space-eating sludge. Mixing results are unconditionally guaranteed.

Lightnin® Mixers

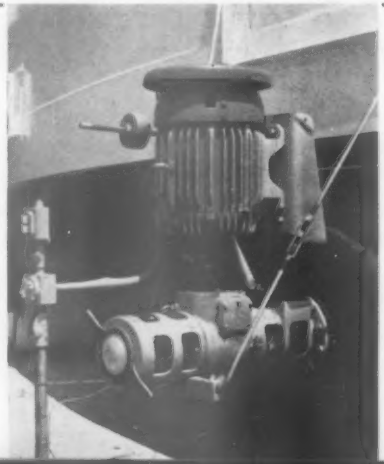
MIXCO fluid mixing specialists

Get these helpful bulletins on BS&W control and LIGHTNIN Mixers. Check, tear out and mail to us today with your name and company address. Free—no obligation.

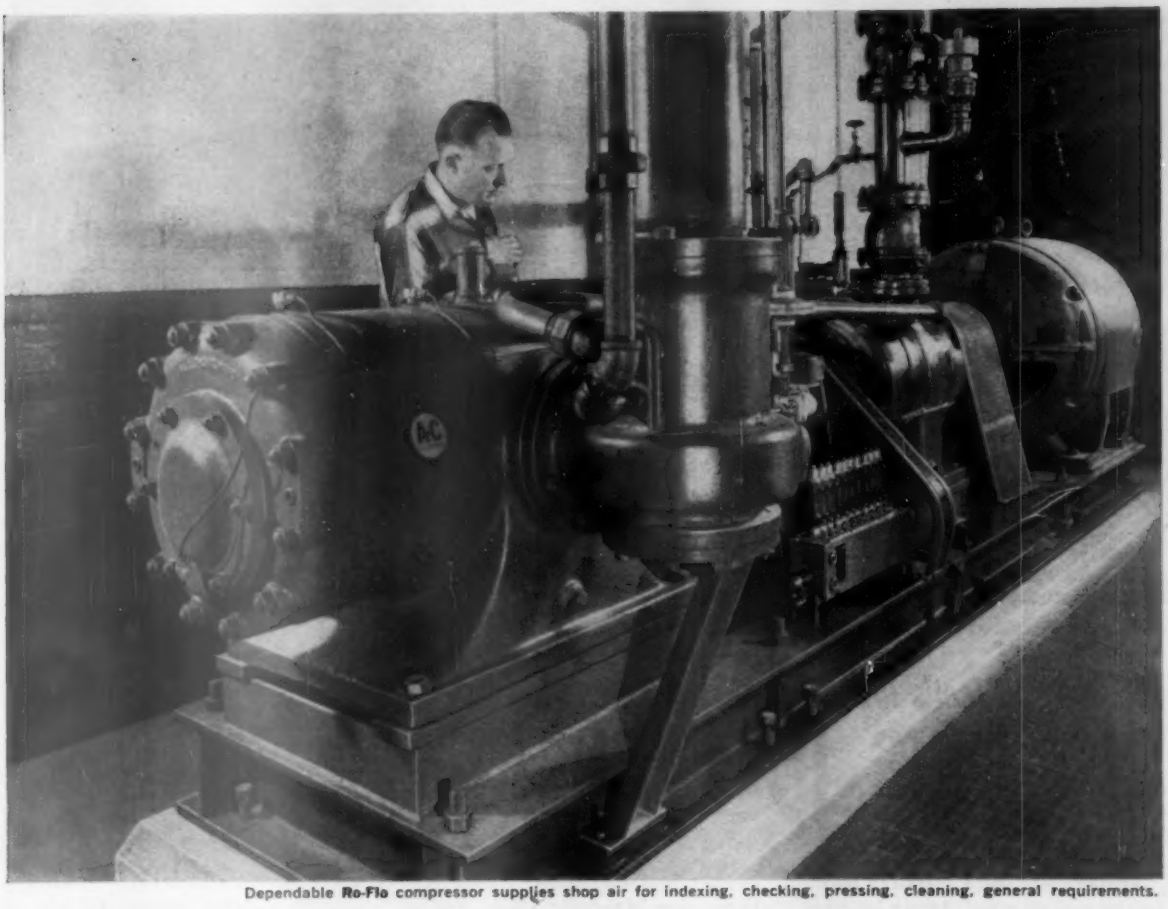
- ☐ BS&W Control with LIGHTNIN Mixers (B-503)
- ☐ Side-entering mixers, 1 to 25 hp (B-104)
- ☐ Data sheet for figuring mixer requirements (B-107)
- ☐ Condensed catalog describing LIGHTNIN Mixers—all types (B-109)
- ☐ LIGHTNIN rotary mechanical seals to eliminate stuffing-box maintenance (B-111)

MIXING EQUIPMENT Co., Inc., 174-m Mt. Read Blvd., Rochester 3, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 19, Ont.



ALLIS-CHALMERS



Dependable **Ro-Flo** compressor supplies shop air for indexing, checking, pressing, cleaning, general requirements.

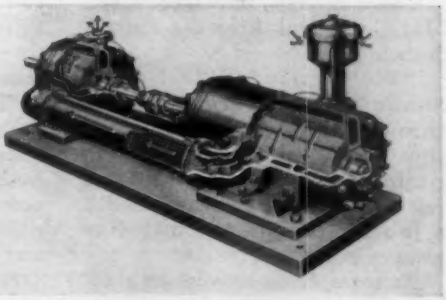
Record-breaking run in Allegan

no new parts for this RO-FLO compressor since installation

With 17 years of trouble-free experience using A-C rotary compressors, Rockwell-Standard Corporation installed this two-stage *Ro-Flo* sliding-vane compressor at their Universal Joint Division, Allegan, Michigan, in January, 1957.

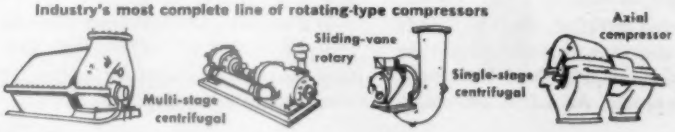
It hasn't let them down. It's been operating 24 hours a day, six to seven days a week, with no major stoppages and no new parts installed since the initial start-up three years ago.

Ask your A-C representative about low-noise, low-maintenance *Ro-Flo* compressors. Or write **Allis-Chalmers,** Industrial Equipment Division, Milwaukee 1, Wisconsin.



Sliding-vane action compensates for blade wear, helps maintain constant efficiency. Rotary motion cuts vibration and noise, eliminates shock and the necessity for expensive foundations. *Ro-Flo* is an Allis-Chalmers trademark. A-1306

Industry's most complete line of rotating-type compressors



LOOKING UP—Length of drill starts into the hole after change of bits. Falcon Seaboard Drilling Co. of Tulsa is drilling this well with a 9,500-foot string of Pittsburgh Seamless 4½-inch Grade E drill pipe. Falcon Seaboard has used Pittsburgh Steel tubular goods and an independent distributor for many years with pleasing results.

Pittsburgh Steel's Independent Distributors...

PUT THIS IN YOUR PIPE---SERVICE!

Drillers who use Pittsburgh seamless on well after well have a lot more than dependable drill pipe, casing and tubing going for them.

They have what Falcon Seaboard Drilling Co. of Tulsa calls "fair treatment from the mill" and—independent distributors who go more than the proverbial extra mile to provide service.

Boone Smiley, manager of the Mid-Continent Area for Falcon Seaboard, said:

"We've used Pittsburgh Steel's independent distributors through the years in times of short supply and when pipe was readily available. We've always felt that Pittsburgh Seamless did a job for us and the mill has always been fair."

Photographs on these pages show effective results of the close relationship between drillers and operators on one side and a Pittsburgh Steel independent distributor on the other. Here, near Maysville, Okla., Falcon Seaboard is using 9,500 feet of Pittsburgh Seamless 4½ inch O.D. Grade E Drill Pipe on the fourth well the string has drilled in the area in recent months.

The independent who supplied this drill string to Falcon Seaboard sold the first string of oil country tubular goods manufactured by Pittsburgh Steel. Continued progress through the years has been based on *service* to the trade.

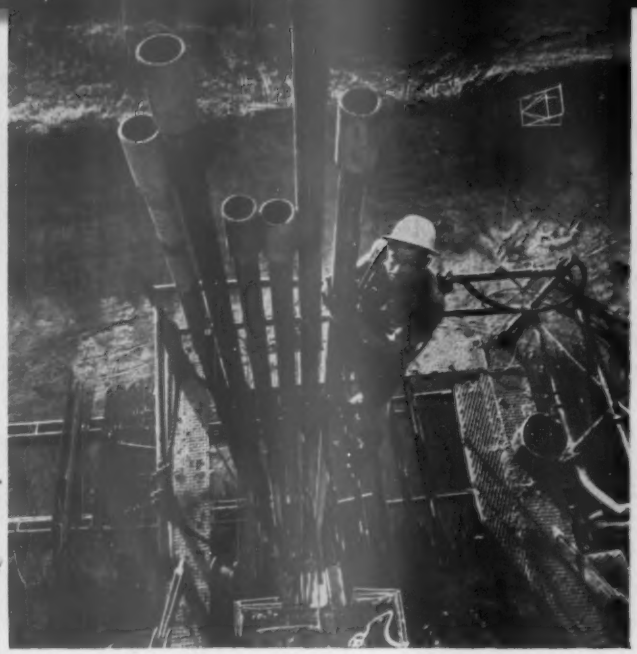
"We can't afford to get lazy," declared William G. Rudd, the distributor's sales manager. "The oil business is always subject to critical emergencies and they all have big dollar signs. It's up to us to pitch in and help."

As a case in point, during periods of acute shortage, this distributor set up a service called the Mid-Continent Pipe Exchange. As a free service to the industry, oilmen were polled for tubular material which they wished to swap for goods more strategically located, or more suited to their needs.

This extra service by Pittsburgh distributors is matched by the extra stamina you always get in Pittsburgh Seamless Drill Pipe—a stamina which stems from long experience in making special steels for the special jobs in the oil country.

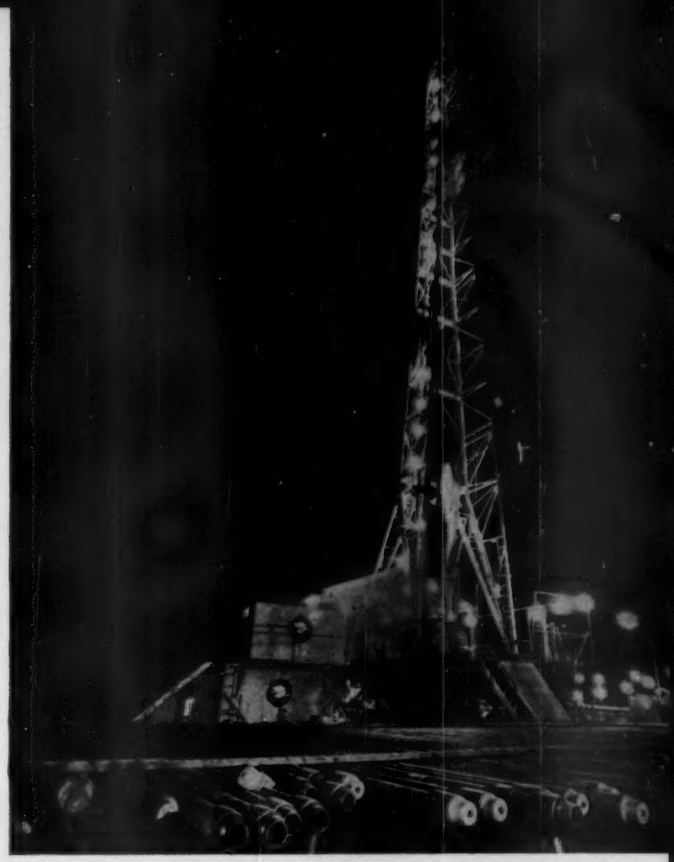
When you buy your next string of drill pipe, or when you're ready to run casing or tubing, remember the combination of Pittsburgh Steel Co. and independent distributors offers you the kind of service—plus the utmost in dependable seamless tubular goods—that isn't available any other place.

It's easy to get lined up with an independent. They're listed at right. Call the nearest one today for quality seamless tubular products.



LOOKING DOWN—On monkey board of 131-foot, A-mast rig, roughneck gets joint of Pittsburgh Steel Co. drill pipe ready for re-entry during a trip. The 9,500 feet of drill pipe shown at top and on racks below was used to drill three previous wells.

Driller Oliver Clark, left, chats with Max Thomas, distributor's representative, and Jewel Smith, Pittsburgh Steel field engineer.



Falcon Seaboard Drilling Co.'s No. 35 rig is at work here on a Sunray Mid-Continent lease near Maysville, Okla.

Geolograph on same rig shows hole is at 4,296 feet with the rotary table, seen at right, operating smoothly. Geolograph chart indicates driller is midway between joint connections.

Distributor Home Offices

Bennett Supply Company
Midland, Texas

Atlas Bradford Company
Houston, Texas

Buckeye Supply Company
Zanesville, Ohio

C. W. Cotton Supply Company
Tulsa 5, Oklahoma

Franklin Supply Company
Denver 10, Colorado

Houston Oil Field Material Co.
Houston, Texas

Industrial Supply Company
Wichita Falls, Texas

Iverson Supply Company
Tulsa, Oklahoma

Longhorn Supply Co., Inc.
Houston 14, Texas

Lucey Export Corporation
New York 7, New York

Lucey Products Corporation
Tulsa 19, Oklahoma

McJunkin Corporation
Charleston 22, West Virginia

Midland Supply Company
Wichita 7, Kansas

Mountain Iron & Supply Co.
Wichita 2, Kansas

The Producers Supply & Tool Co.
Fort Worth 2, Texas

Production & Refining Equipment Company
Odessa, Texas

Sandy Supply Company
Wooster, Ohio

Southwest Supply Company
Pittsburgh, Pennsylvania

The Straker Supply Company
Jackson, Michigan

Superior Iron Works & Supply Co.
Shreveport, Louisiana

Tex-Tube, Inc.
Houston 7, Texas

Western Supply Company
Tulsa 1, Oklahoma

Pittsburgh Steel Company

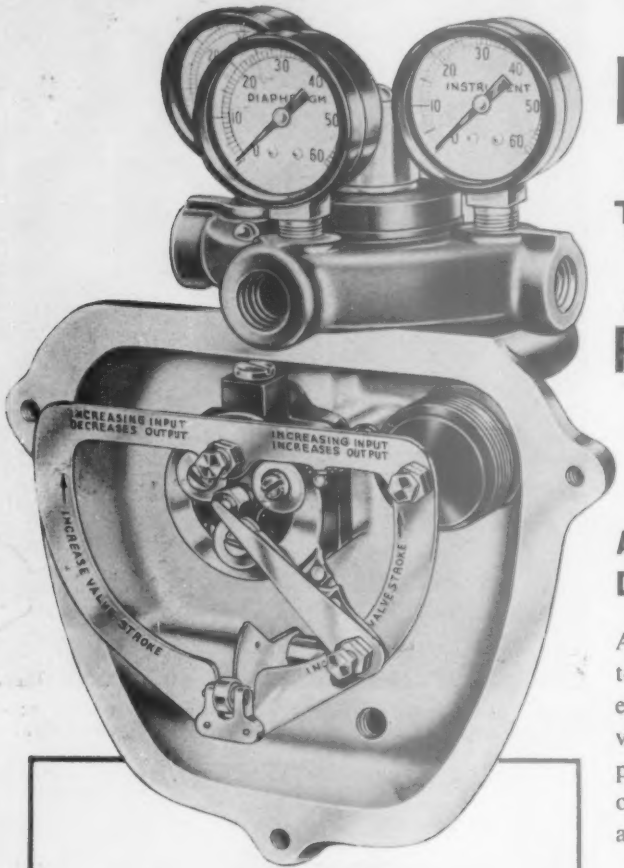
Grant Building • Pittsburgh 30, Pa.

DISTRICT SALES OFFICES

Atlanta	Cleveland	Detroit	Los Angeles	Pittsburgh
Chicago	Dayton	Houston	New York	Tulsa
			Philadelphia	Warren, Ohio

Steel

A new concept in design makes possible the...



FISHER

TYPE 3560 VALVE POSITIONER

V/P

Assured product performance through DYNAMIC ANALYSIS engineering

Application of mathematical techniques of design to pressure control systems has enabled Fisher to eliminate the conventional approach in the development of the new V/P valve positioner. It has provided the V/P with the following combination of characteristics and performance . . . unobtainable in any other type of valve positioner.

SMALL AND COMPACT . . . only 6⅝" wide and 8¾" high (with gauges).

CONVENIENT ADJUSTMENT . . . valve stroke and zero adjustment readily accessible and easy to make.

SPLIT RANGE . . . no parts change whatsoever is required for split range operation.

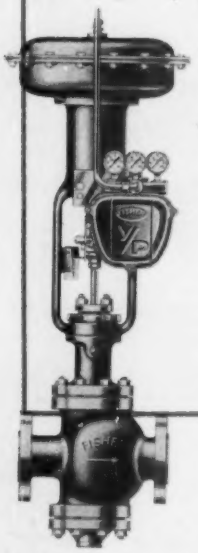
EASILY REVERSIBLE . . . reversed by simply moving flapper arm from one beam quadrant to the opposite quadrant.

CHARACTERIZED CAMS . . . offer wide flexibility in valve characteristics.

PERFORMANCE DATA

Hysteresis, (Average)	0.0012"
Linearity	as required. Change cams to obtain desired characteristics
Sensitivity	0.14 psi
Resolution Sensitivity	0.002 psi
Repeatability	±0.0003"
Stroking Speed	0.37 in/sec.
Air Consumption	10 scfh
Break Frequency (5% of instrument pressure range)	3.9 cps
Break Frequency (3% of instrument pressure range)	4.6 cps

The above performance data was taken from laboratory tests on a Type 657 diaphragm actuator, Size 40, with 1½" travel. Instrument range 3 to 15 psi.



Write today for Bulletin E-3560

IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD . . . CHANCES ARE IT'S CONTROLLED BY...

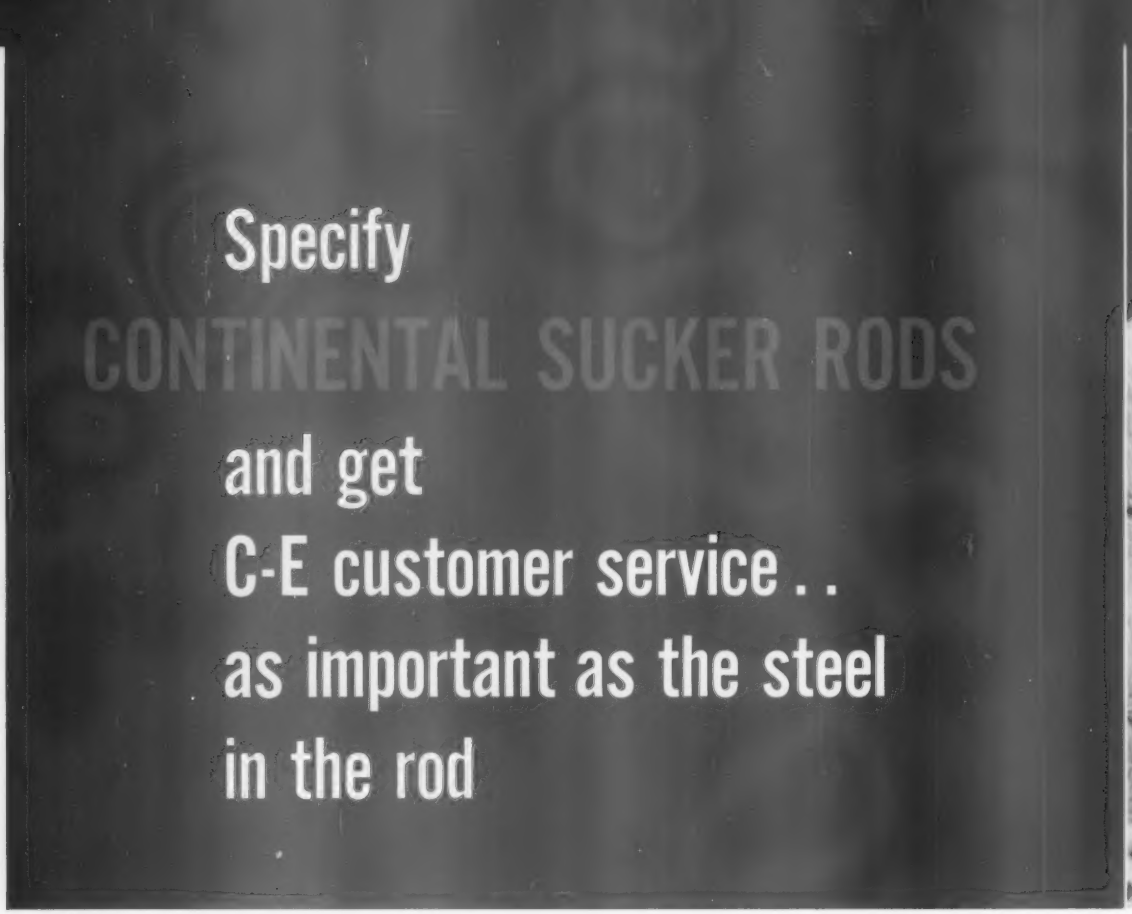
FISHER GOVERNOR COMPANY

Marshalltown, Iowa / Woodstock, Ontario / Rochester, England

BUTTERFLY VALVE DIVISION: CONTINENTAL EQUIPMENT COMPANY, CORAOPOLIS, PA.

FISHER® Controls

SINCE 1880



Specify CONTINENTAL SUCKER RODS and get C-E customer service . . as important as the steel in the rod

In this day of *tighter profits*, it pays to look beyond the type of steel or grade of rod . . and view the service and facilities behind the sucker rods you buy. *Profit conscious* companies are doing just that . . directing their personnel to specify Continental sucker rods and couplings. And here's why . .

Continental-Emsco service cuts pulling costs

. . let a Continental-Emsco Production Specialist have your well fluid or sucker rod failure analyzed. Through Continental-Emsco's metallurgical facilities, he can determine the corrosive content of the fluid . . spot the cause of the rod failure . . and recommend the *right* rod for the longest possible pumping . . *this C-E service costs nothing extra!*

Continental-Emsco service reduces your engineering costs

. . plant trained C-E men can engineer an optimum rod string for minimum weight and the lowest possible stress

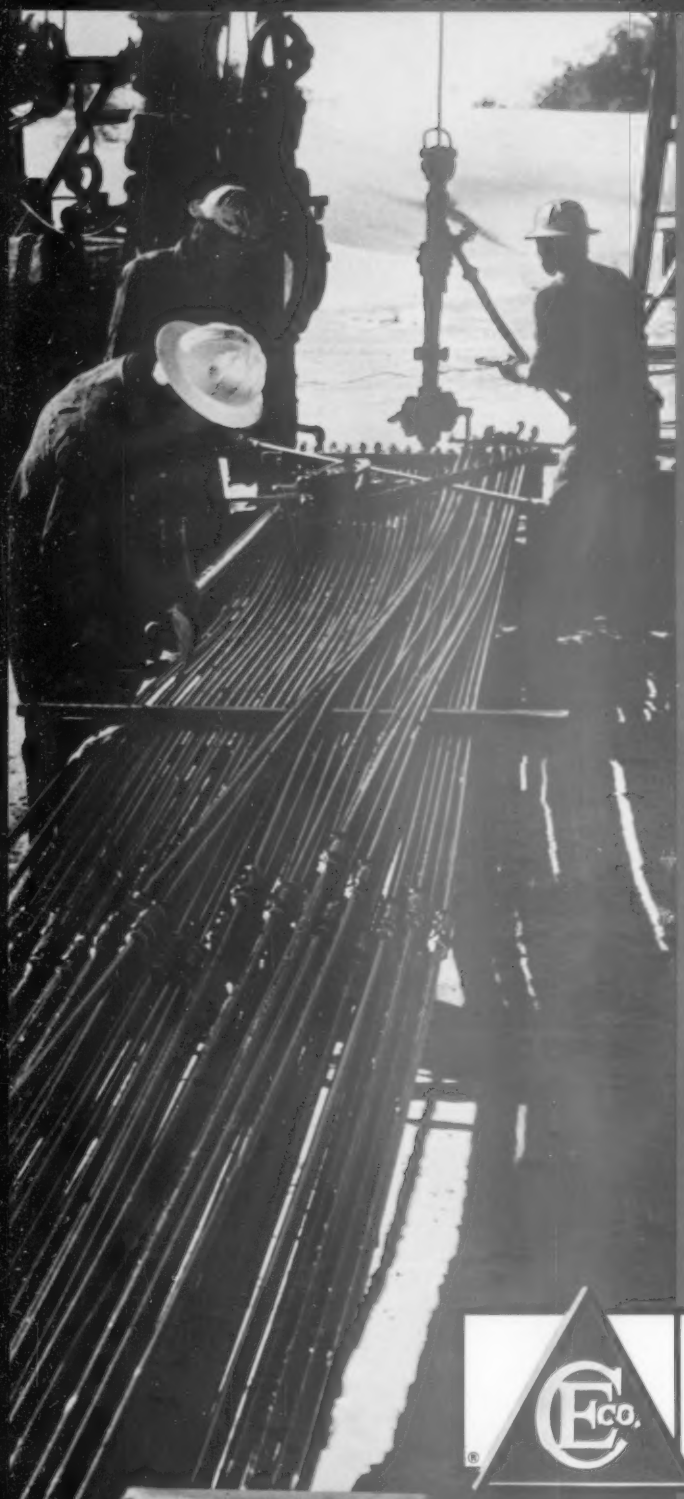
on top rods, unit pumper and prime mover.
This service relieves the work load of your engineering department while providing you with the experience and knowledge of men that are specialists in this field of engineering . . *another C-E service that costs nothing extra!*

Continental-Emsco service reduces your operating costs

. . C-E specialists are fully trained and qualified to make a dynamometer analysis of your wells.
Their recommendations will help eliminate many of the causes of sucker rod failure . . and guide you in proper counterbalancing to (1) cut power costs and (2) reduce wear on equipment. *This C-E service, too, costs nothing extra!*

Continental-Emsco service extends equipment life

. . C-E specialists are always available to train your crews in the right way to handle sucker rods and other subsurface equipment in the field for maximum life . . *additional C-E service that costs nothing extra!*



Are you pulling too many wells.. because you're buying steel alone?

CONTINENTAL-EMSCO

Serving the Oil and Gas Industries ... Worldwide

You can always depend upon Continental Sucker Rods

Anywhere in the world

Continental-Emsco, a fully integrated supply company, is able to maintain constant quality control of Continental sucker rods from raw ore to your well.
Close liaison is maintained with the parent company, The Youngstown Sheet and Tube Company, to assure steels of uniform quality, reflecting the latest improvements developed through continuous metallurgical research.
C-E's sucker rod plant operates under rigid quality control standards.
Wholly-owned supply stores and exclusive representatives throughout the world provide Continental-Emsco quality . . regardless of where you're producing.

For maximum performance . . maximum service . . Specify *Continental sucker rods*

CONTINENTAL #1

An [illegible] rod with [illegible] staying power in noncorrosive wells or where an inhibitor is used . . yield strength range 60-75,000 psi.

CONTINENTAL #5

A medium [illegible] rod with an amazing performance record, primarily due to vanadium, which gives it a strength equalling many so-called "high tensile" rods . . yield strength range 71-92,000 psi.

CONTINENTAL #8

The new Continental #8 rod is priced lower than Continental's premium #10. It offers a moderate degree of corrosion resistance plus top load capacity . . typical yield strength 113,000 psi.

CONTINENTAL #10

The premium quality of this rod results in exceptionally long pumping life in deep, problem and hard pumping wells, where its high ductility and corrosion resistance pay off . .
yield strength range 95-110,000 psi.

CONTINENTAL #11

The finest rod in the Continental line. Its low carbon and high nickel content provides high load carrying capacity in corrosive wells . . yield strength range 90-105,000 psi.

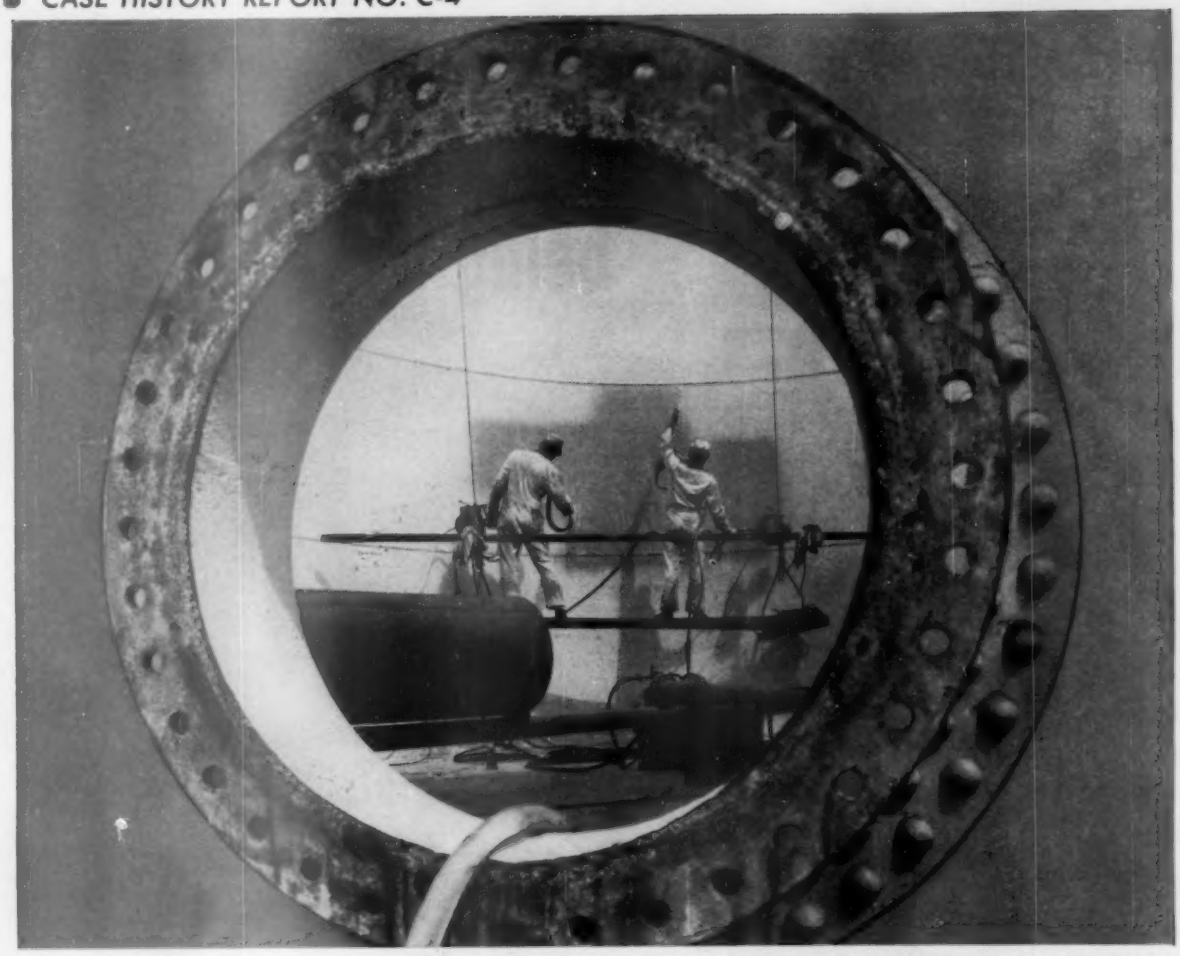
CONTINENTAL-EMSCO

Serving the Oil and Gas Industries ... Worldwide

CONTINENTAL-EMSCO COMPANY • A Division of The Youngstown Sheet and [illegible]
Export Division: 30 Rockefeller Plaza, New York, N. Y. • Continental-Emsco Company Limited • General Offices: Calgary, Alberta, Canada • Representatives in All Principal Oil Fields of the World
Continental-Emsco Company C. A., Caracas, Venezuela • Plants: Houston and Garland, Texas; St. Albans, Herts, England •

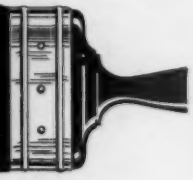
SR 020

● CASE HISTORY REPORT NO. C-4



Interior of storage tank being coated by applicators of National Marine Coatings, Inc., San Pedro, California

Urethane coating resists solvent action . . . prevents rust contamination of aviation fuels



The urethane coating on the interior of Richfield Oil Corporation's storage tank for jet fuel is expected to last five years—at least 25% longer than the uncoated tank itself would last in direct contact with aviation fuels.

A serious problem in the oil and gas industries is tank metal loss through solvent action of stored petroleum products, leading to rust contamination of the fuel. After 2½ years of intensive research on this problem, Richfield concluded that the urethane coating (Laminar X500*) provides full bondage against vapor permeation of corrosive fuels which attacks other coatings within 30 days to one year after application.

Tests show that this highest-quality urethane coating, formulated with Mobay's Mondur CB resin, resists corrosion and abrasion better than six others tested—all epoxy, vinyl and silicon-zinc types. Labor savings up to 10% result from urethane's drying time of one hour at 70°F and 50% humidity. Flash point during application is 100°F., a full 15° higher than other standard coatings tested.

For further information on urethane coatings for maximum performance under extreme conditions, write Mobay Chemical Co., Code OG-6, Pittsburgh 5, Pa.

Mobay is the only domestic supplier of all the basic chemicals required to formulate the various urethane coatings systems, and developed the original technology for urethanes in the U. S.

MOBAY

First in Urethane Chemistry

*T.M. Magna Coatings & Chemical Corp.

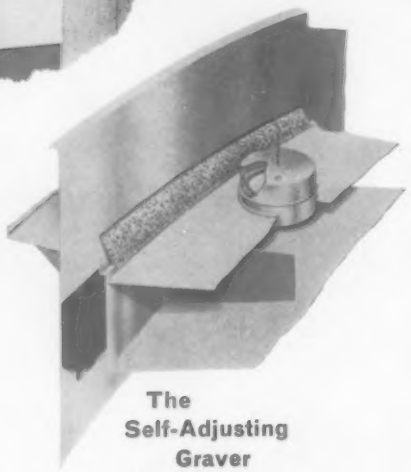
An ounce of pressure is worth being sure...

Just one ounce of pressure is needed to keep the Graver Pressure Seal at work preventing vapor loss in floating roof tanks.

The Pressure Seal, inflated with air, expands to fill the varying gap between the roof and the shell of the tank, thus assuring sustained contact against the shell better than any solid or liquid pressure-type seal.

In addition to preventing loss of vapor, the Graver Pressure Seal minimizes corrosion . . . adds to the fire-resistant characteristics of floating roof tanks.

Write us today for information on how Graver floating roof tanks with the Pressure Seal can help you with your tankage problems.



The Self-Adjusting Graver Pressure Seal

Graver

ONE OF THE UNION TANK CAR COMPANIES

Graver Tank & Mfg. Co.

EAST CHICAGO, INDIANA

PLANTS AND OFFICES ACROSS AMERICA

. . . at products pipeline terminal of nationally known oil company

The LimiTorque Valve Controls shown above are of the *Integral Control Type* (pioneered by LimiTorque). . . *These self-contained "packaged units" offer integrally mounted NEMA rated reversing controllers, push-button and indicating light elements . . . The push-button elements, selector switches, etc. are all mounted inside the hinged cover for quick, easy accessibility.

LimiTorque "Integral Control" Valve Operators can save up to 50% over separate component equipment and installation costs—and, they are simple, foolproof and absolutely dependable. Send for LimiTorque Bulletin 10-A58, which completely describes and illustrates these new and exclusive Units.

There is no guess work or labor connected with LimiTorque Valve Controls—one man can open and close any type of valve, quickly and dependably in remote or hazardous locations.

LimiTorque may be actuated by any reliable power source, such as Electricity, Oil, Gas, Water or Air.

LimiTorque Operators can be field-mounted on existing valves . . . contact your valve manufacturer or nearest LimiTorque sales-engineering office.

THERE IS NO SUBSTITUTE FOR —

LimiTorque®

PHILADELPHIA GEAR CORPORATION
KING OF PRUSSIA (SUBURBAN PHILADELPHIA), PA.
Offices in all Principal Cities

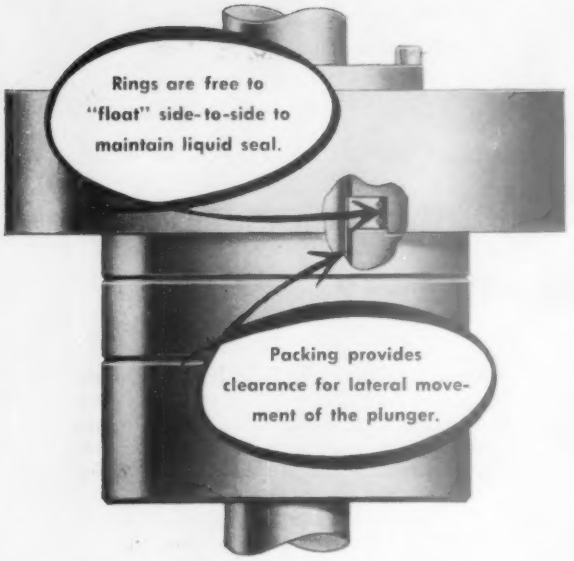
INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID AGITATORS • FLEXIBLE COUPLINGS
Limitorque Corporation • King of Prussia, Penna.

ENGINEERING

NEWS YOU CAN USE ABOUT ENGINE AND COMPRESSOR PERFORMANCE

THIS LIQUID-PUMP PACKING ACTUALLY FLOATS TO ELIMINATE COSTLY LEAKAGE PROBLEMS

Cook's special full-floating, self-adjusting packing boosts performance, reduces downtime of high-pressure plunger pumps


Rings are free to "float" side-to-side to maintain liquid seal.
Packing provides clearance for lateral movement of the plunger.

Plungers of all liquid pumps tend to "run out of true." As a result, conventional packings must make room for this lateral movement with a clearance around the plunger. Thus, a path is soon formed and excessive leakage occurs. This leakage can be reduced by adjustment but soon starts again.

To eliminate this annoying and expensive packing problem, Cook has designed a special liquid-pump packing which has proved itself in a number of varied field applications. This Cook packing actually *floats with the movement of the plunger.* It doesn't have to make room for the "run-out" of the plunger—it simply moves with it!

Cook packings are now successfully handling all types of liquids—oil, water, chemicals, brine, etc.—under many special operating conditions. These self-adjusting packings now make possible trouble-free performance without frequent adjustments. They are adaptable to all new or existing pump designs and become part of the permanent pump assembly. Ask a C. Lee Cook representative to give you the details about this special liquid-pump packing.

WRITE FOR MORE INFORMATION

If you want Cook engineers to review the special requirements of your specific liquid-pump packing application, just send the necessary details to C. Lee Cook Company, 934 South Eighth St., Louisville 3, Ky. Or send for complete information about any of Cook's complete line of rings and packings.

COOK SEALS LIQUIDS AT EXTREME PRESSURES AND TEMPERATURES

C. Lee Cook has unique experience in the advancement of liquid-seal technology. Recently completed research and development contracts (one with a major airframe and missile manufacturer) have resulted in new concepts of seal design, materials compatibility, friction limitations and sealing efficiency. If yours is a special packing application, call in a Cook representative.

C. LEE COOK COMPANY

Division of Dover Corporation

Rings and Packings Since 1888

Another FRANKS First

The advanced triangular TRI▲SCOPE DERRICK!

Replaces the Double Pole Mast where it is desirable to pull doubles for rod and tubing work.

HANG RODS • RACK PIPE

Greater speed with features such as automatically positioning rod and stacking boards. Top section automatically locks into position.

GREATER STRENGTH

Triangular construction gives greater strength with less weight. Rated 100,000# with 2-to-1 safety factor. 90′ derrick.

LESS GUYING

Minimum guying required for wind protection only. Rigs up faster than clumsy 87 ft. double pole.

HYDRAULICALLY RAISED POWER EXTENDED

Single hydraulic ram raises mast. Excellent visibility adds to many other safety features.

Call your Franks representative for the exciting details, or write for specifications folder

WELL SERVICING AND DRILLING UNITS

FRANKS

PAMPA, TEXAS

CABOT

CABOT CORPORATION
MACHINERY DIVISION

ALCOA makes Pipeline History on First Underwater Completion Well!

...with one and a quarter miles of light, strong Alcoa Aluminum Pipe flexible enough for launching in heavy surf and sweeping crosscurrents

The flexibility, light weight and outstanding corrosion resistance of ALCOA® Aluminum Pipe made important contributions to the success of the world's first underwater ocean oil well completion by Peruvian Pacific Petroleum Co. □ Located on the ocean bottom, 132 feet down, the wellhead is 6,200 feet from shore. Its flow system is Schedule 40 aluminum pipe—a 3-in. flow line and a ½-in. hydraulic valve control line. □ Peruvian Pacific, a subsidiary of Cities Service Co., as operator in the joint venture with Richfield Oil Co., had good reason to select aluminum. With the wellhead on the bottom, submarine pipelining was called for. That demands pipe with superior corrosion resistance. ALCOA Aluminum Pipe has it—with no need for costly coatings or wrappings. □ Just as important, since the pipe was to be launched in one continuous length through heaving surf and strong sea currents, it had to be flexible enough to roll with the punch. Aluminum's favorable modulus of elasticity gives just that kind of flexibility. □ Illustrated at right are frames from a new motion picture showing this historic piping operation . . . job-site storage of the specially fabricated 50-ft pipe sections . . . welding into continuous lengths . . . bundling of the two pipe sizes . . . stringing down the beach . . . launching through pounding surf and racing currents in which the pipelines were deflected by hundreds of feet without rupture. □ The complete film of this exciting operation will be shown by ALCOA at the Chicago meetings of API. Be sure to contact an ALCOA representative there. He'll gladly arrange for you to see the film. □ A paper detailing the Peruvian Pacific operation will shortly be published. To reserve a copy, write ALUMINUM COMPANY OF AMERICA, 865-L Alcoa Building, Pittsburgh 19, Pa. □ World-wide sales through ALCOA INTERNATIONAL, INC., 230 Park Avenue, New York 17, N. Y.

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

O·C·T

PRESENTS
THE ULTIMATE IN
LOW PRESSURE TUBING HEAD
SIMPLICITY, FLEXIBILITY, ECONOMY

Here it is . . . a low pressure tubing head that combines three all-important factors—*simplicity*, *flexibility* and *economy*.

With this new unit you can use tubing stripper in combination with other equipment if desired, without the necessity for adding stripper housing or bowl.

Threaded tubing hangers are available for use with or without the stripper.

Ease of installation: It's a cinch!

Ruggedness? It's tough as a boot!

When you need a low pressure head, you can get the best from

O·C·T

OIL CENTER TOOL CO.

SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

Address Export Inquiries for All Countries to
P. O. Box 3091, Houston, Texas.

where progress is a daily practice

New Series of Marsh Needle Valves in 316 STAINLESS STEEL

—Valves that take you out of your corrosion problems

Now still wider service range for the valves that have set new standards in the needle throttling field. A full line of Marsh Needle Valves are immediately available in 316 stainless steel in the new series 1936.

Identified by blue handles

Here is a valve that opens up the wide range of corrosion-resistant applications bracketed by 316 stainless. It is a valve that gives precision throttling at pressures from a few pounds through 6000 psi . . . a valve for any temperature from minus 100° F. to plus 500° F. thanks to the "Marpak" packing system making use of precision moulded Teflon.

Only Marsh experience—in both valve making and instrument making—could have produced these valves. Like other Marsh needle valves, they are available in globe and angle patterns and in panel mounted types; sizes, ⅛", ¼", ⅜", ½", ¾" and 1". The 316 stainless valves are fully described in Bulletin NV-3.

Marsh Needle Valves are also available in 416 stainless steel (identified by green handles) and in mild steel (identified by yellow handles.)

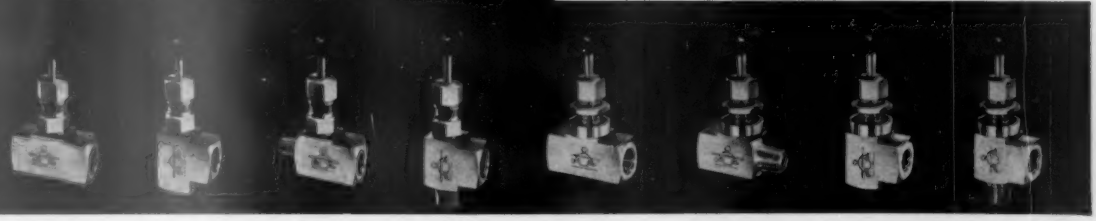
The Marsh touch—
the precision touch—in every detail

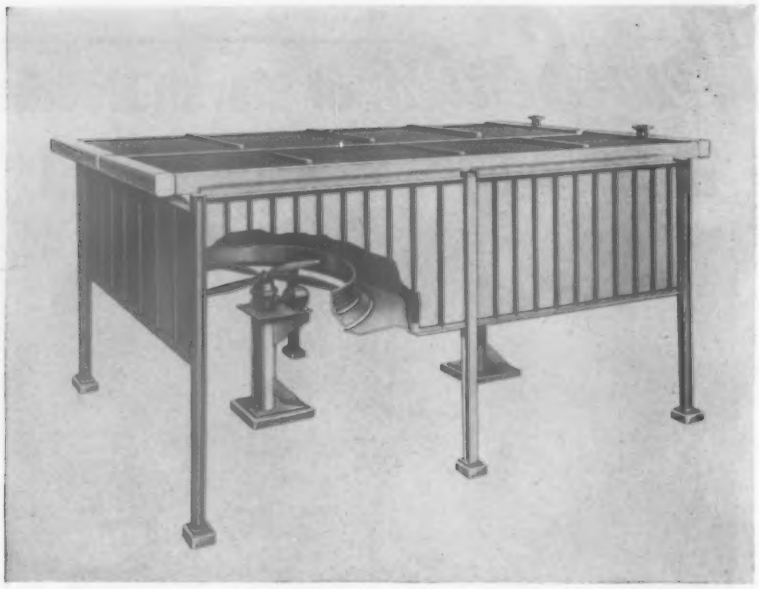
- Body and stem guide machined from 316 stainless bar stock.
- Accurately machined stem, precision ground and rolled.
- Longer inlet and outlet thread chambers insure tight make-up.
- Packing as corrosion-resistant as the valve.

MARSH *Needle Valves*

MARSH INSTRUMENT COMPANY, Dept. L, Skokie, Ill.
Division of Colorado Oil and Gas Corporation
Marsh Instrument & Valve Co. (Canada) Ltd.
8487 183rd St., Edmonton, Alberta
Houston Branch Plant, 1121 Rothwell St.,
Sect. 15, Houston, Texas

In stock at your nearest Supply House





Cutaway View of G-R Forced Draft Fin-Fan Air Cooled Heat Exchanger Showing the Fan, Drive Mechanism and the G-R K-fin Cooling Sections.

G-R Fin-Fan Air Cooled Heat Exchangers

Efficient cooling when water is scarce—often preferred even when water is readily available and inexpensive

G-R Fin-Fan Air Cooled Heat Exchangers eliminate the initial costs and maintenance costs of shell side pumps, piping, valves, also water and water treatment. They reduce the foundation costs, power costs and minimize fouling and corrosion problems. Easily installed. No field welding. Modular design permits easy expansion of capacity.

Forced draft and induced draft designs featuring even air distribution. Use of G-R helically finned transfer surface balances heat transfer coefficients of air and fluid being cooled, resulting in efficient heat transfer and economical operation. Choice of drive arrangements, fan size, draft controls and weather protectors.

Widely used and highly endorsed by leading gas producers, refiners, chemical companies and engineer-contractors. Installations throughout the world. For the best by far choose G-R.

Write for G-R Fin-Fan Bulletin No. 2401 Today!

Griscom-Russell

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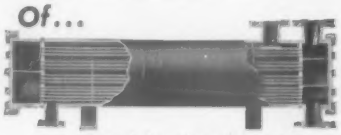
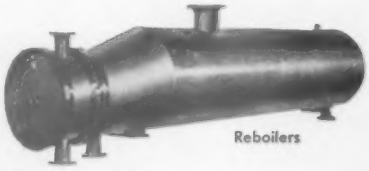
221 Wetmore Avenue, **Massillon, Ohio** • Phone TEmple 2-8751
Engineering and Sales Representatives in the Principal Cities

Also Manufacturers Of...



Style B Bare Tube Heaters

Twin G-Fin Sections



Reboilers

G-R Shell and Tube Heat Exchangers, Feedwater Heaters, Twin G-Fin Sections, Scale-Shedding Evaporators, Tank Heaters, After-coolers, Steam Generators, Ship and Land Base Sea Water Distilling Plants, Fin-Fan Coolers, Recuperators and Finned Tubing.

C. H. WHEELER Power Plant Condensers and Vacuum Equipment, Water Supply Drainage and Circulating Pumps, and Marine Auxiliary Machinery.

THE GRISCOM-RUSSELL CO.
Massillon, Ohio
C. H. WHEELER MFG. CO.
Philadelphia 32, Penna.
Subsidiaries of
HAMILTON-THOMAS CORPORATION
Hamilton, Ohio

ELECTRONIC MUD-COST ANALYSIS

Another Milwhite Aid to Decreased Drilling Costs

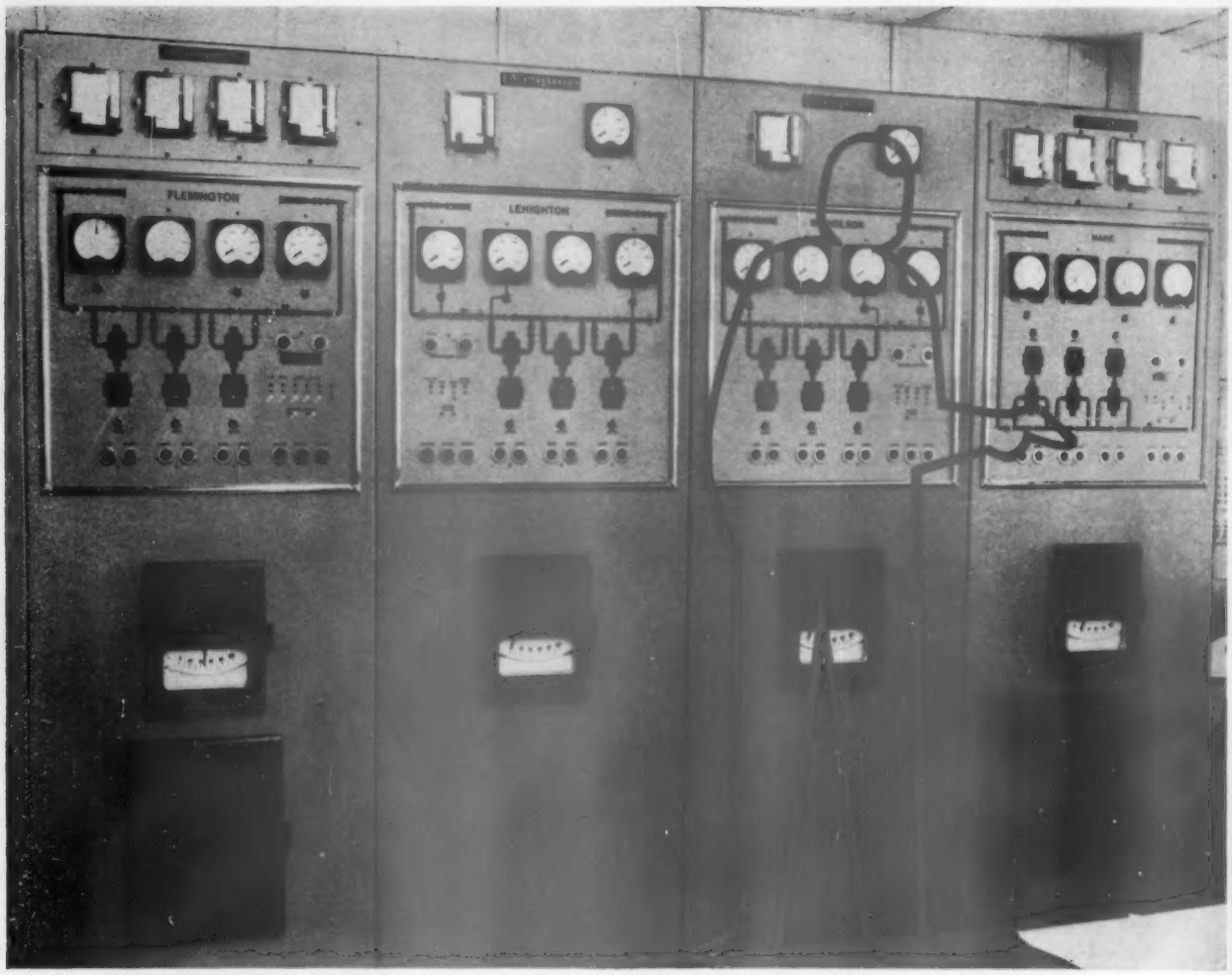
Customer service in all phases of Milwhite operations is graphically illustrated in the above photographs. Invoices are prepared daily to facilitate the accounting work of Milwhite customers in maintaining accurate and current cost records on all new wells. Utilizing information from invoices, Milwhite is electronically preparing Mud Cost Analysis reports on each and every well serviced. Through a special numbering system, well locations are pinpointed by counties or parishes. In furnishing information for cost estimates for future drilling in the same area, the records quickly provide information on all products used previously on wells in the area and complete historical cost information. Soon, mud cost records and the complete engineering report for each well will be microfilmed and united in one card to provide a complete history of each well drilled in one readily accessible reference. These records, with the specific approval of the operator of each well drilled, will allow drilling operators to more accurately estimate future well costs for proposed locations in the same area. Complete cost analysis records will be provided in multiple copies on all wells serviced on completion of the well rather than the present manually prepared records on request. Just one more step in Milwhite's continuing program to provide the best, complete service.

MILWHITE

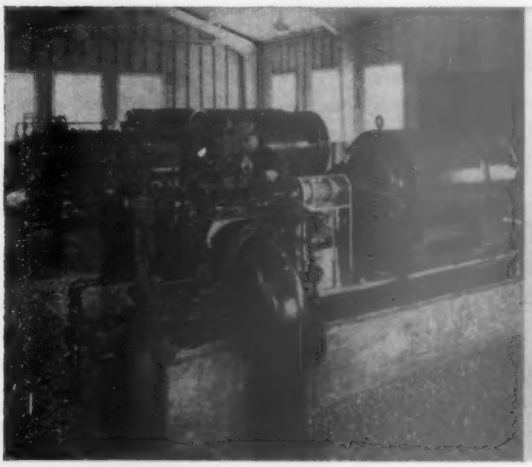
MUD SALES COMPANY

HOUSTON, TEXAS

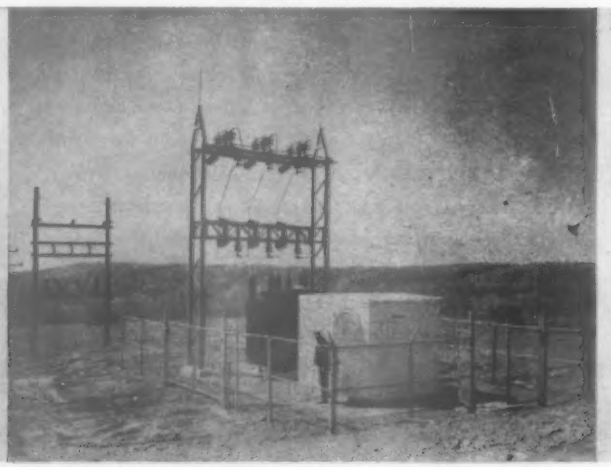
DIVISION OF MISSISSIPPI RIVER FUEL CORPORATION



CONSTANT SURVEILLANCE of operations at Buckeye's automated booster station is maintained by a Westinghouse control system. Indicator lights alert the dispatcher in Macungie, Pa., of any equipment trouble.



"NO MAJOR REPAIRS in 10 years." That's Buckeye's forecast for the huge, explosion-proof Westinghouse pump motors at the heart of Buckeye Pipe Line's new, remotely controlled booster station. Electrically powered stations like this Westinghouse-equipped installation at Maine, N.Y., are in sharp contrast to older, steam-operated stations needing 14 men around the clock.



"BEST POSSIBLE DESIGN" is Buckeye's opinion of 2000-kva Westinghouse transformer which steps incoming 34,400-volt power down to 2300 volts. Highly efficient operation was achieved after computer evaluated all possible design variables. Transformer's Insuldur® insulation system permits overloads with no reduction in service life.

WESTINGHOUSE AUTOMATES BUCKEYE PIPE LINE'S NEW 120,000-BARREL BOOSTER STATION FOR REMOTE CONTROL

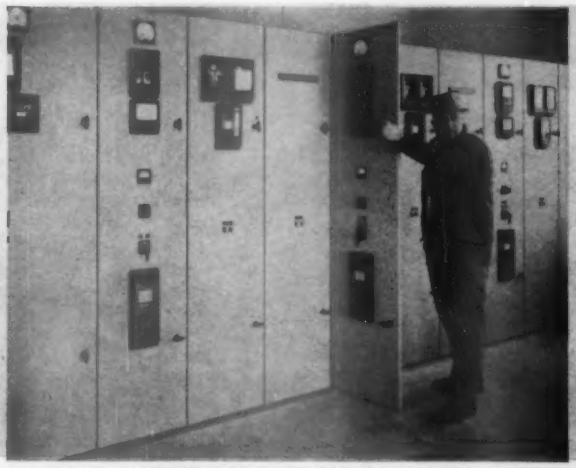
A dispatcher in Macungie, Pa., can completely control operations at Buckeye Pipe Line Company's new booster station 200 miles away, at Maine, N.Y. The Westinghouse-equipped station was built to step up Buckeye's capacity from 80,000 barrels per day to 120,000 barrels per day. The installation is the newest of five booster stations along a 14-inch pipeline that delivers refined oil products for 14 oil companies located from Linden, N.J., to Buffalo, N.Y. The Buckeye booster station at Maine represents the latest advances in pipeline automation.

"The station," reports the station foreman, "is seldom attended in person . . . and then by only one man. From the power transformer, switchgear and fault detection system to the electric pump motors, Westinghouse equipment enables our Allentown dispatcher to control pumps at the station, and learn from remote recording instruments the operating conditions of any one of the three motors, as well as the emergency shutoff valves. Any emergency warning lights that flash in the station will also flash in Macungie so that the dispatcher always knows whether everything is in proper working order."

The three 2300-volt Westinghouse pump motors provide 500 hp, 600 hp and 700 hp for pumping gasoline and heating oil. Pump power is converted to 2300 volts from an incoming 34,400 volts by a 2000-kva, oil-filled, outdoor Westinghouse transformer. A smaller service transformer, rated 75 kva, supplies power for lighting and auxiliary equipment.

To aid pipeline operators in achieving more efficient, cost-saving distribution, Westinghouse offers a long-term, step-by-step plan leading to economical automatic operation. It is called *Progressive Automation*. For more facts about *Progressive Automation*—call your closest Westinghouse representative. Or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. *You can be sure . . . if it's Westinghouse.* J-96157

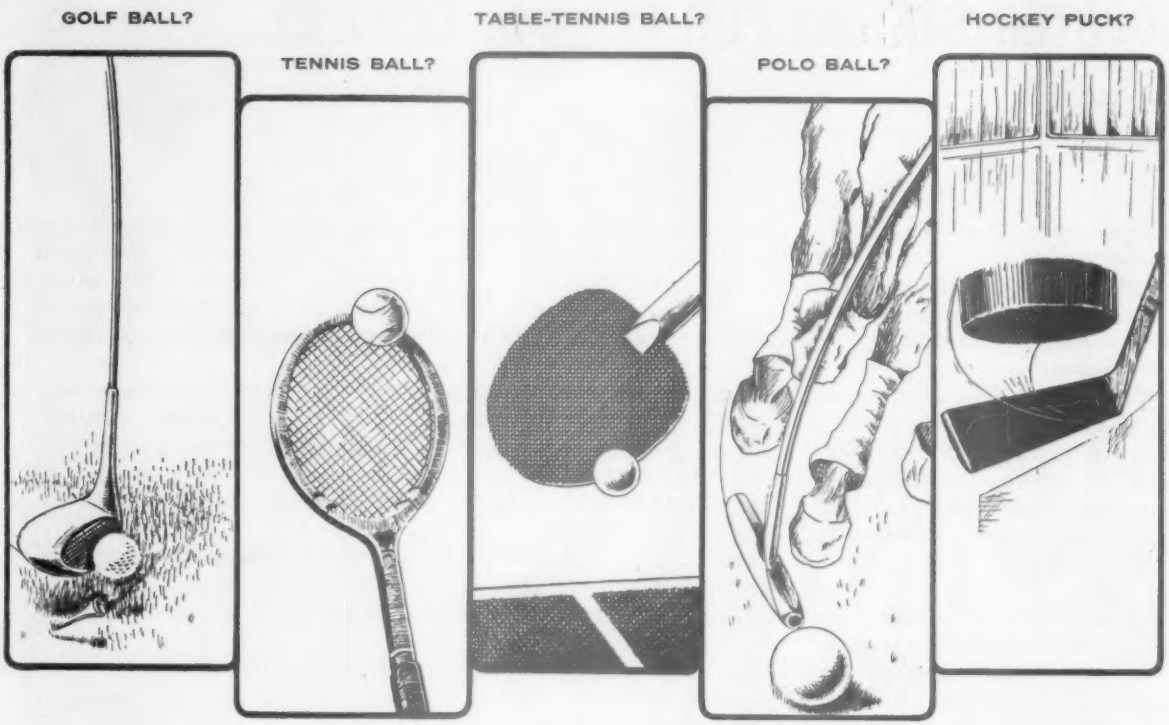
Westinghouse



RELIABLE CIRCUIT PROTECTION for station's electrical system is provided by Westinghouse metal-clad switchgear. Maintenance is facilitated by use of horizontal drawout-type DH magnetic air circuit breaker. Switchgear can be remotely or locally operated.

ADEQUATE POWER AND PROTECTION for supervisory controls, lighting and auxiliary station equipment are supplied by Westinghouse control center. Center is composed of interchangeable, space-saving, easily installed modular units.

Which travels slowest?



Can you tell the real thing when you see it?

Which travels most economically . . . truck, train, or barge? For each user of caustic, there is usually one correct answer.

Is it barge shipment for you? We have found that a great many caustic users who could take advantage of the economies of water transportation are not doing so. We ship caustic by barge from plants in Michigan and Louisiana. We also ship by truck or tank car. Let us help you make the correct choice.

Wyandotte offers a number of chemicals for the petroleum industry, including materials for drilling muds, gas dehumidification, demulsifying, emulsifying, secondary recovery, water treatment, cementing, sweetening, and many other petroleum, refinery, and petrochemical applications. Get full details from your distributor, or write: *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Baton Rouge, Louisiana. Offices in principal cities.*

ANSWER: The polo ball and the hockey puck tie for last at 100 m.p.h. A golf ball has been clocked at an incredible 170 m.p.h., a tennis ball at 130 m.p.h., and a table-tennis ball at 110 m.p.h.

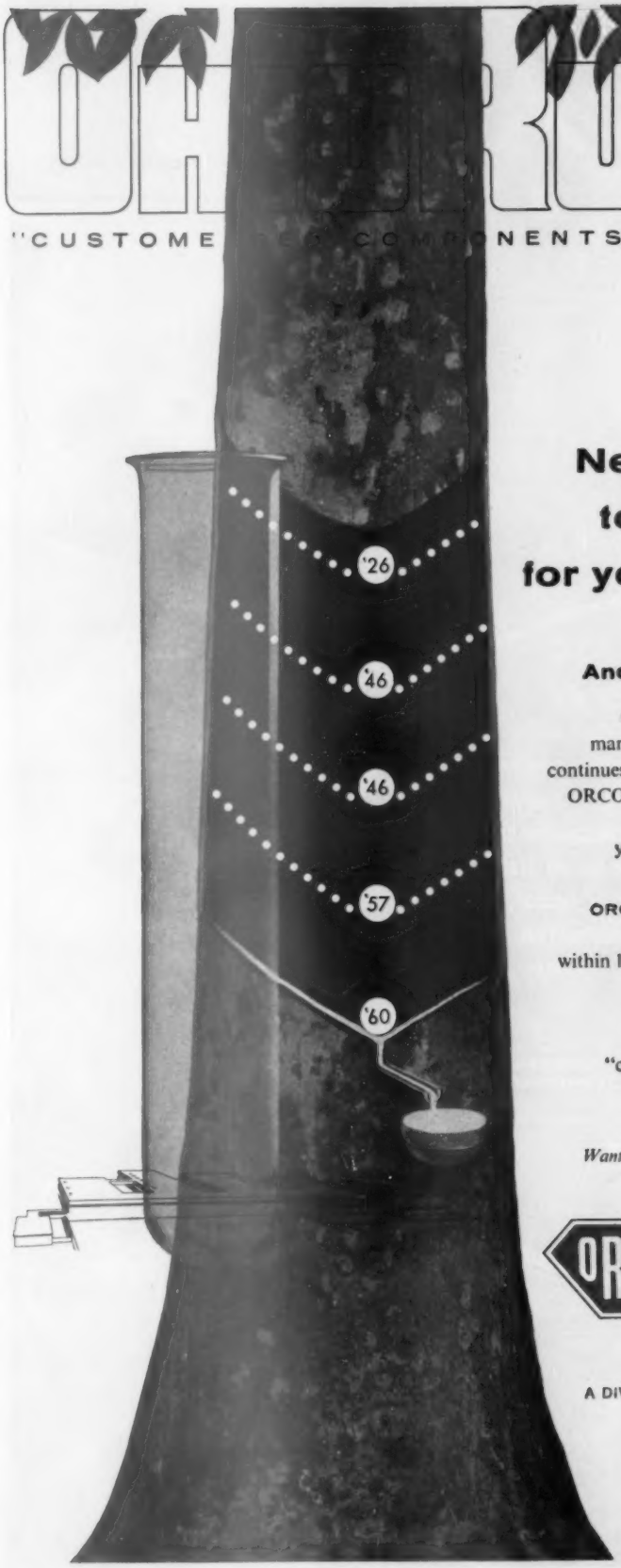
* * * * *

WYANDOTTE CHEMICALS
MICHIGAN ALKALI DIVISION

Pacing progress with creative chemistry

OHIO RUBBER

"CUSTOMEERED" COMPONENTS BASIC TO INDUSTRY"



New plant growth to tap for your rubber needs

And you made it possible!

Ohio Rubber's history of plant growth and manufacturing expansion dates back to 1926—continues through 1946 and 1957. And, in late 1960, ORCO opens its new Fort Smith, Arkansas plant—dedicated, as with the others, to serve you better—to supply your increasing needs for custom components.

ORCO SUM TOTAL: 5 major, geographically strategic plants . . . 1,200,000 square feet within 143 acres . . . over 2000 trained employees . . . diverse products of natural and synthetic rubber, neoprene, polyurethane, flexible and rigid vinyl . . . "customer-friends" like you across the board in industry, nationwide.

Want to know more about Ohio Rubber? Write today for our "Customeering" bulletin.

MF-300

ORCO THE OHIO RUBBER COMPANY

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A DIVISION OF THE EAGLE PICHER COMPANY

To conquer the peat bogs
of Wisconsin, Houston Contracting
literally took to the air. Recently completed for
the Michigan-Wisconsin Pipe Line Company, this
24-inch, natural-gas pipe line was constructed through some
of the most unstable ground in the United States. Efficient
operation over all types of terrain is typical of Houston's
on-time handling of engineered construction. When you're
thinking of pipe lines, talk to the men at Houston.
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OIL • GAS • PRODUCTS
WATER PIPELINES

AT COSDEN . . .

After five years' experience in operating Combin-aires, Cosden Petroleum Corporation, at its Big Spring refinery, has installed its FOURTH Hudson Combin-aire.

The Combin-aire is an integrated structure combining a water cooling tower with fin-tube hot fluid to air exchangers. Ambient air is cooled as it is drawn thru the water, and the cooled air serves as the cooling medium for the fin-tube coolers. Thus, with fin-tube coolers, effluent process stream temperatures may be reduced far below those obtained with ambient air.

The Combin-aire may be used primarily as a cooling tower, with the advantages of double use of air, and, because hot effluent air is undersaturated, complete elimination of spray carry over or condensation. Or when water is scarce, or salt, or brackish the Combin-aire may be used primarily for fin-tube cooling, using minimum water of any quality for pre-cooling air.

DEPENDING UPON DESIGN OBJECTIVES THE COMBIN-AIRE MAY HAVE SOME OR ALL OF THE FOLLOWING ADVANTAGES:

- Absolute minimum water consumption consistent with attainment of low terminal process stream temperatures.
- Water circulation may be made automatically responsive to air temperatures with no water circulated except at high ambient temperature.
- No water treatment necessary. Salt water or brackish water may be used.
- No spray carryover or condensation. After passing across the fin-tube elements the heated air leaving the Combin-aire at elevated temperature is undersaturated with water vapor and cannot precipitate condensate or carry water spray.
- Minimum piping. Combin-aire may be installed immediately adjacent to other process equipment.
- Clean air to fin-tube units. During the hot season air is washed, removing dust, sand and insects.

Effluent temperatures of process streams may be accurately controlled with HUDSON Auto-variable pitch fans.

HUDSON

ENGINEERING CORPORATION

BRAEBURN STATION • HOUSTON, TEXAS

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New Collins DC system insures uninterrupted communication...when you need it most!

Now... security against even momentary outages during power-disrupting storms. Collins' dc-powered Microwave and Carrier Systems operate directly from float-charged batteries — eliminating rotating machinery. The results: improved reliability, reduced power drain, lower maintenance, decreased noise and elimination of standby generators. Several voltage combinations are available, enabling you to select the one that best integrates with your existing plant. For technical literature, write Collins Radio Company, Texas Division Sales, 1930 Hi-Line Drive, Dallas 7, Texas.

COLLINS MICROWAVE AND CARRIER

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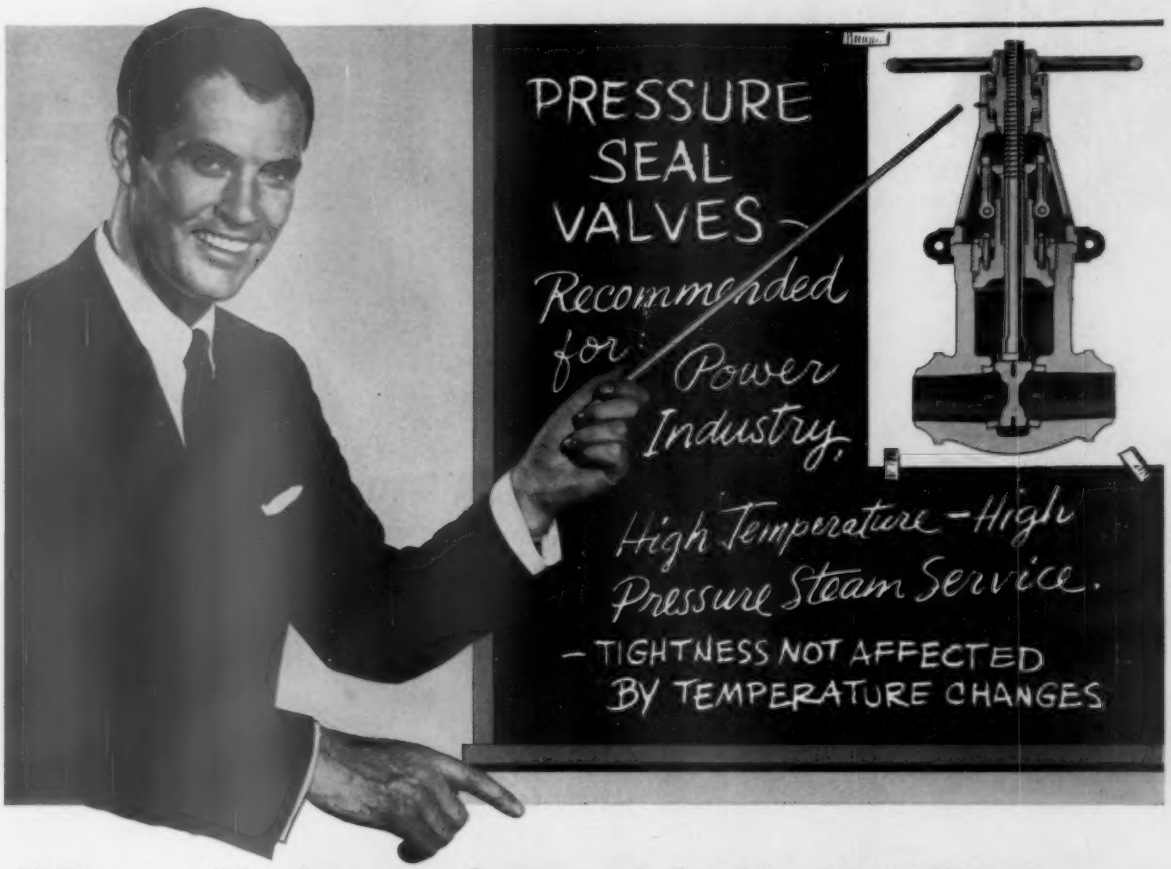

"See...No heavy bonnet bolts to adjust on R-P&C Pressure Seal Valves"

"The R-P&C Pressure Seal Valve pictured here is an outstanding example of a modern valve designed for modern service. Built to give **absolute tightness** under high temperature, high pressure conditions, it has **no heavy bonnet bolts** to adjust. Instead, bonnet bolts and flanges are replaced by a pressure seal bonnet joint which completely eliminates leakage even when pressure and temperature are reduced during a line shutdown. Moreover, the bonnet joint on this valve may be removed and reassembled with greater ease than a conventional bolted bonnet."

Notice, too, that this valve has a **compensating type wedge** which adjusts for tight closure and overcomes sticking or jamming when wedge is seated.

Castings for all pressure seal valves are produced in R-P&C's own steel foundry and are subject to critical internal examination by our own Radiographic X-ray equipment.

R-P&C Pressure Seal Valves are available through 14" size in Gate Valves and through 8" size in Globe and Lift Check Valves. All are available in the 900-1500 and 2500 pound classes.

For complete details about pressure seal valves or any valve in the R-P&C line, **consult your R-P&C distributor.**

R-P&C VALVES

ACCO

R-P&C Valve Division, American Chain & Cable Company, Inc.

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

Nothing less than Autocar satisfies oil-field service men. They know that however tough the going, Autocar walks through it.

"Oil-field service is tough . . . BUT AUTOCAR'S TOUGHER!"

Toughness—and the ability to take it under *all* conditions—is what Autocar brings to oil-patch service, and what makes oilmen say, "Anything *less* than an Autocar in our work doesn't last long."

Autocars get there in a hurry . . . over the roughest terrain, day and night, without fail. Pipe, rigs, cement, chemicals or what-have-you, are all taken in stride.

Each Autocar is custom-engineered to meet the specific conditions of the job. And each has the quality, the performance and the stamina you need for the toughest jobs.

Your service is one where time is most important. Why should you settle for less than the "World's Finest"? White-Autocar comprehensive service throughout the U.S.A.

Autocar
"World's Finest"

Division of
The White Motor Company
Exton, Pa.

WECO®

the best connections for all oil country piping

WECO UNIONS

On the drilling rig . . . in production installations . . . in service company operations, WECO Unions give you maximum service, economy, efficiency . . . mean faster, simpler, more secure piping make-up. Available in types, sizes and pressure ratings for every oil field service, you can standardize with WECO Unions and always have the right union in the right place at the right time. Talk to your WECO representative about it, now . . . *and ask him about Chiksan Swivel Joints, too.

WECO® WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS
Division of CHIKSAN COMPANY *a subsidiary of* FOOD MACHINERY AND CHEMICAL CORPORATION

U-7-60

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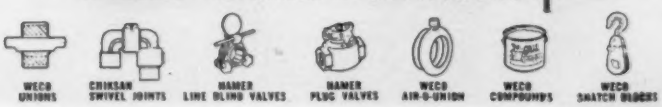

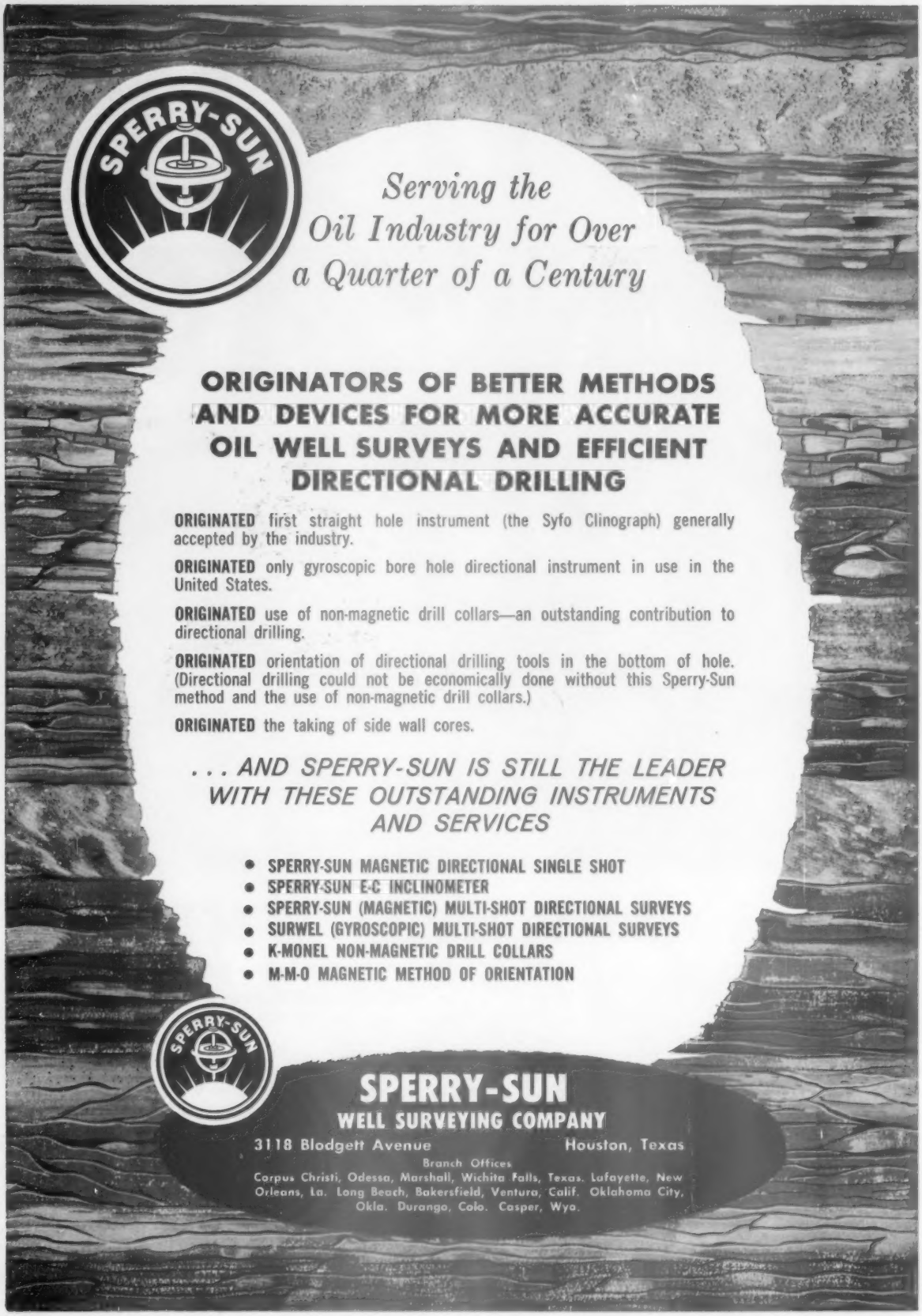
SPERRY-SUN
Serving the
Oil Industry for Over
a Quarter of a Century
ORIGINATORS OF BETTER METHODS AND DEVICES FOR MORE ACCURATE OIL WELL SURVEYS AND EFFICIENT DIRECTIONAL DRILLING
ORIGINATED first straight hole instrument (the Syfo Clinograph) generally accepted by the industry.
ORIGINATED only gyroscopic bore hole directional instrument in use in the United States.
ORIGINATED use of non-magnetic drill collars—an outstanding contribution to directional drilling.
ORIGINATED orientation of directional drilling tools in the bottom of hole. (Directional drilling could not be economically done without this Sperry-Sun method and the use of non-magnetic drill collars.)
ORIGINATED the taking of side wall cores.
. . . AND SPERRY-SUN IS STILL THE LEADER WITH THESE OUTSTANDING INSTRUMENTS AND SERVICES
• SPERRY-SUN MAGNETIC DIRECTIONAL SINGLE SHOT
• SPERRY-SUN E-C INCLINOMETER
• SPERRY-SUN (MAGNETIC) MULTI-SHOT DIRECTIONAL SURVEYS
• SURWEL (GYROSCOPIC) MULTI-SHOT DIRECTIONAL SURVEYS
• K-MONEL NON-MAGNETIC DRILL COLLARS
• M-M-O MAGNETIC METHOD OF ORIENTATION
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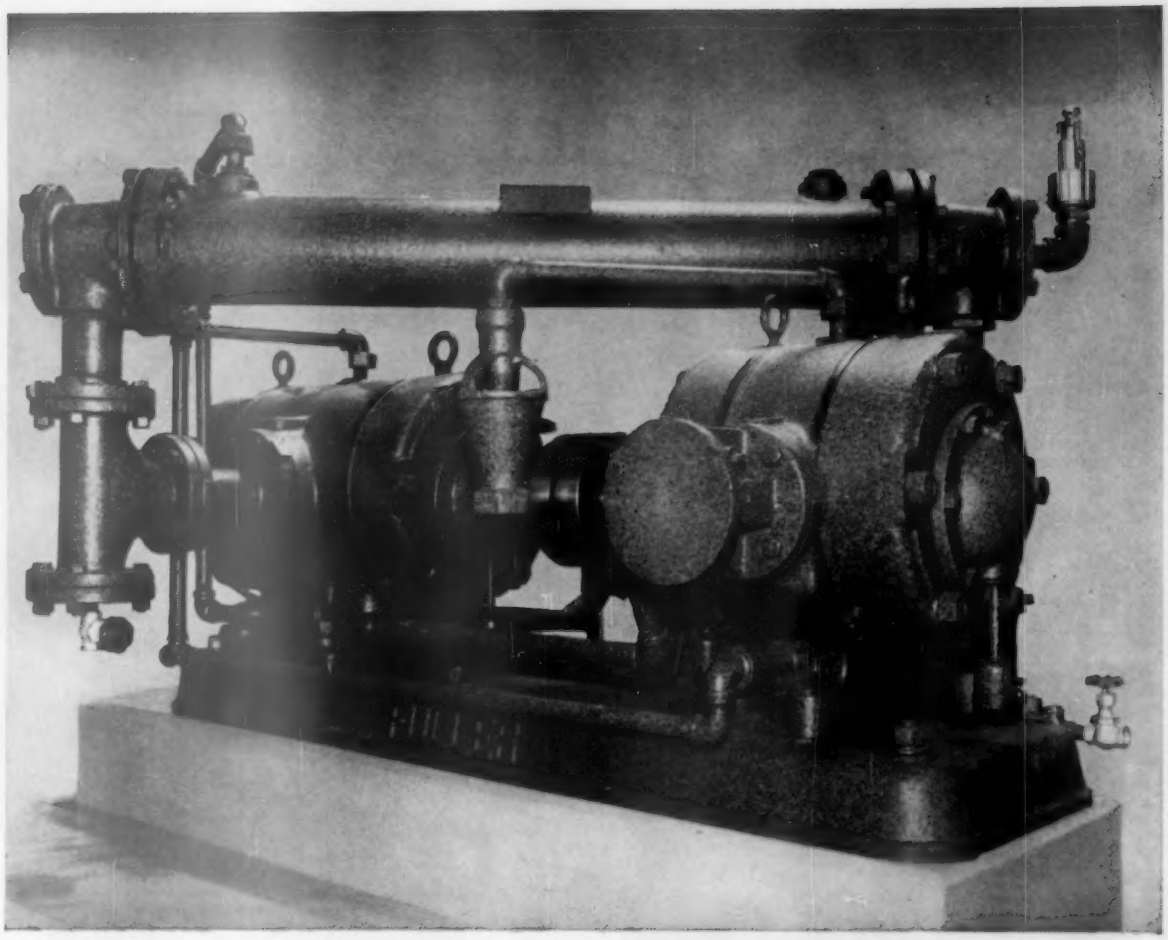

Fuller Compressors With Overhead Intercoolers Offer A New Dimension In Compactness

Fuller Rotary Two-Stage Compressors equipped with Overhead Intercoolers fill the bill where space may be a problem. These compressors produce from 30 to 3300 cfm, pressures to 125 lb. gage and can be readily installed.

These compact Rotary Compressors are vibration-free, thereby eliminating the need for involved and expensive foundations or structural modifications.

The Fuller rotary principle permits complete freedom of reciprocating parts—valves, crankshafts, pistons—cutting the need for frequent servicing and parts replacement. Minor maintenance is all the care indicated for years of serviceability.

For full details on the maintenance-free economy and high performance of Fuller rotaries, write today for comprehensive, illustrated Bulletin C-5A. 2626 C359

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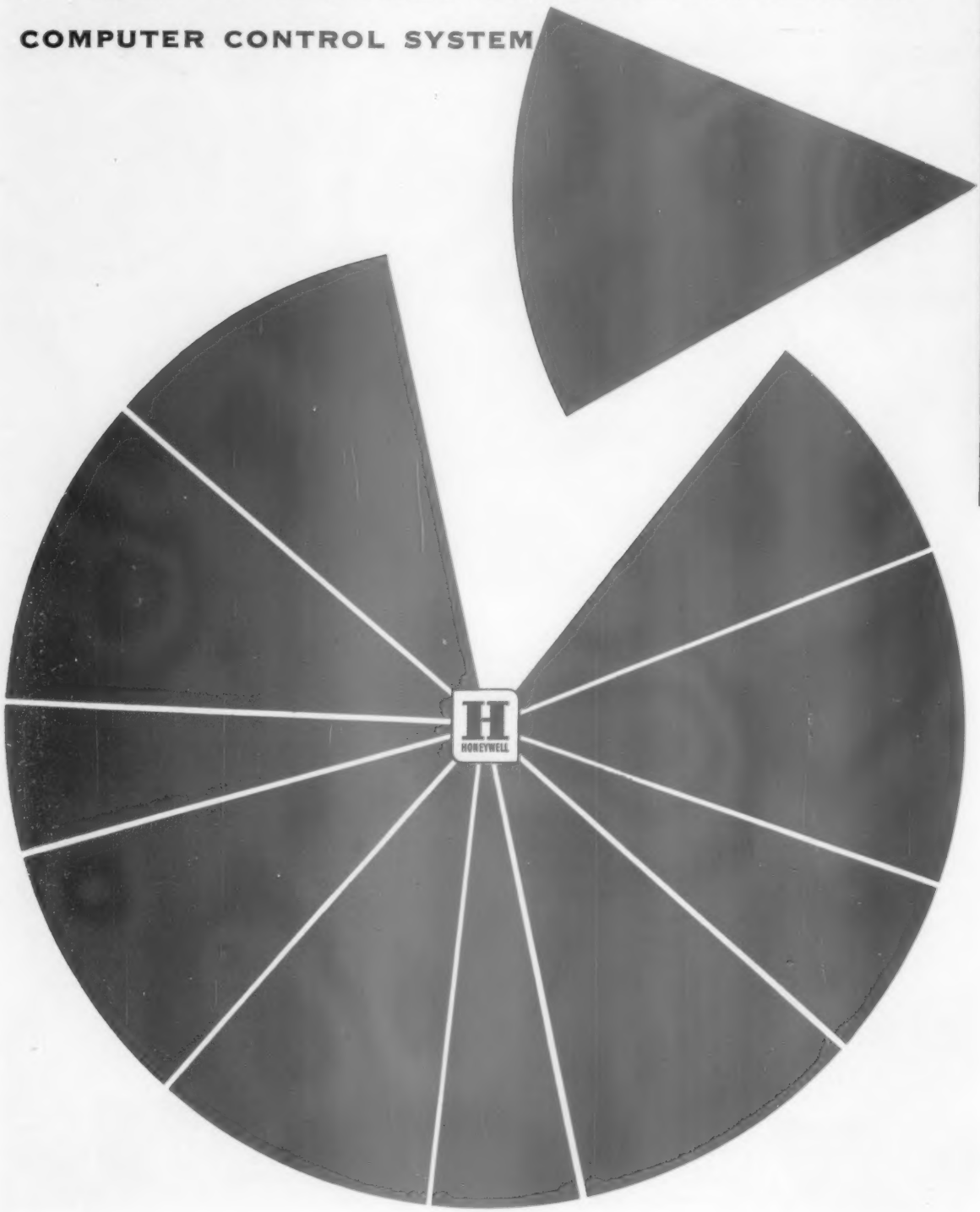
GENERAL AMERICAN
TRADE MARK

FULLER COMPANY
132 Bridge St., Catasauqua, Pa.
Subsidiary of General American Transportation Corporation
Offices in Principal Cities Throughout the World

Fuller
.... pioneers in harnessing AIR

NEW HONEYWELL 290 INDUSTRIAL DIGITAL COMPUTER

. . . HEART OF THE FIRST COMPLETELY INTEGRATED COMPUTER CONTROL SYSTEM



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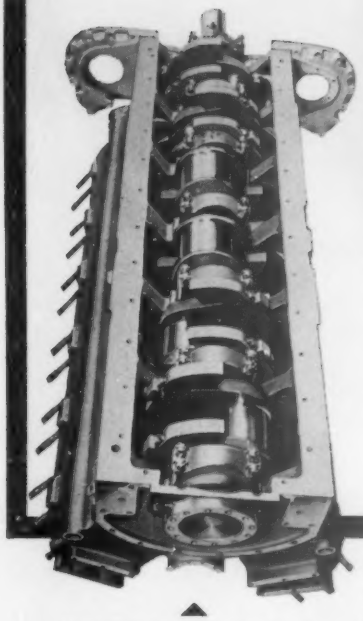
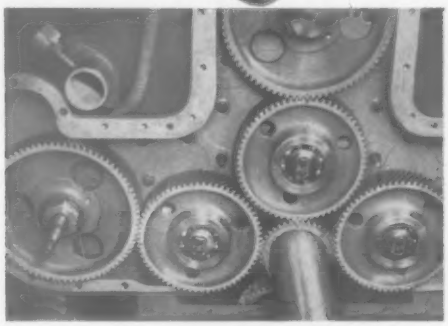


Crankshaft and main bearings in place in a typical Waukesha V-12 oil field engine. Note heavy flanges, thick bearing webs, rugged long-life construction.

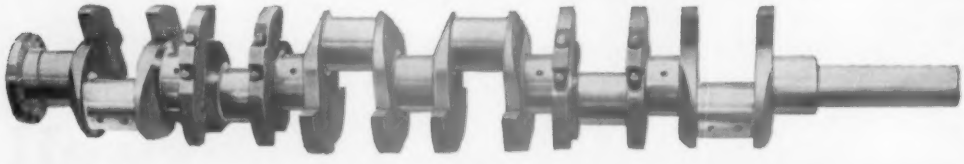
Precision-built and balanced rod assemblies, matched with pistons. Pressure oiled, mirror smooth, heavy pins. Replaceable bearing shells.

Removable wet cylinder sleeves of close-grained alloy iron, finished for oil retention and long life. Heavy duty, aluminum alloy, oil-cooled pistons.



Wide-faced helical cut timing gears are flood oiled. Materials selected for long, quiet life and accuracy. Gears and all elements in the power train, from pistons to flywheel, are precision-machined in Waukesha shops under Waukesha Quality Control.

Rifle-drilled, drop-forged, heat-treated crankshafts, precision-ground to exacting Quality Control standards. Note extra large bearing areas. Statically and dynamically balanced.



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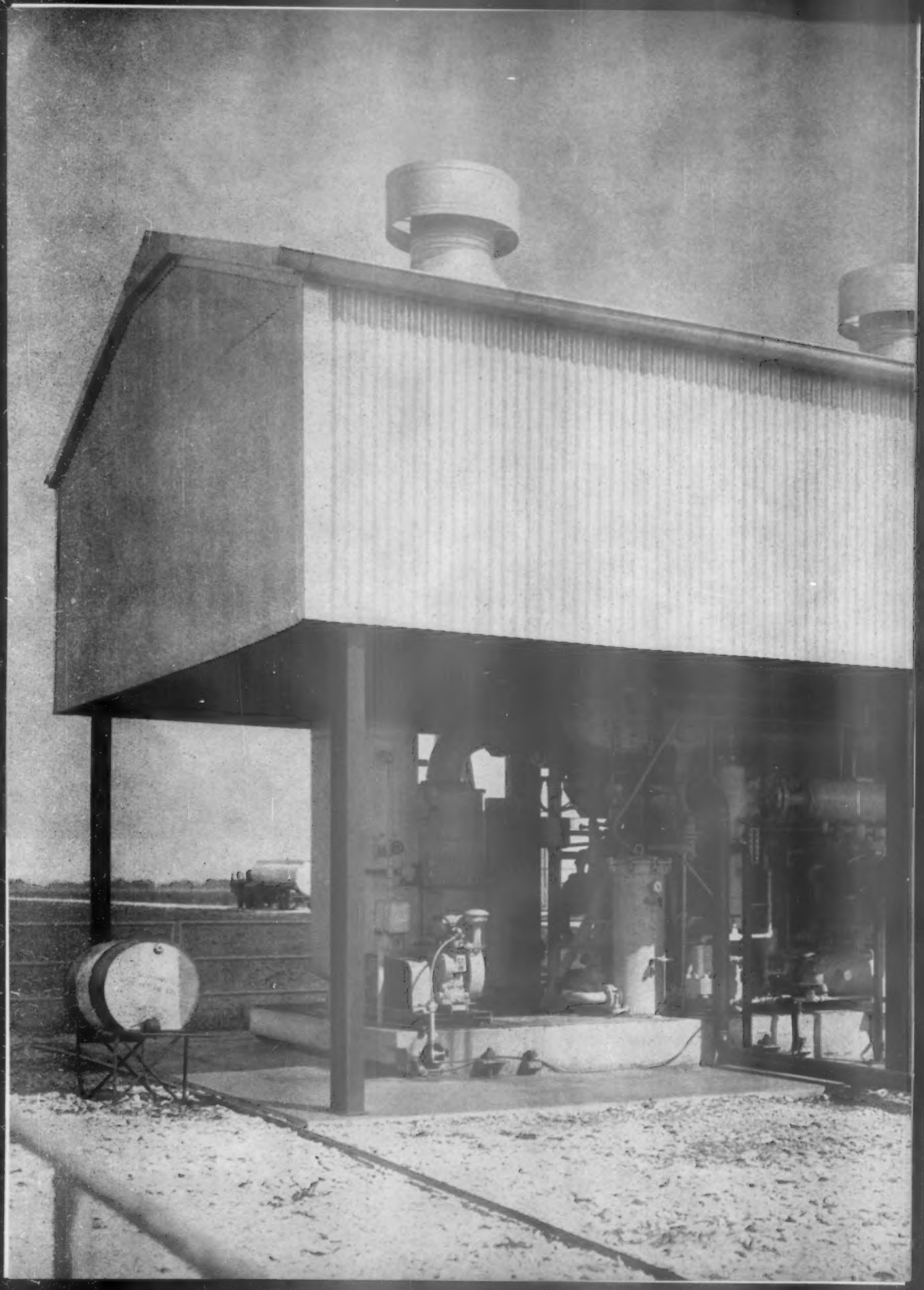

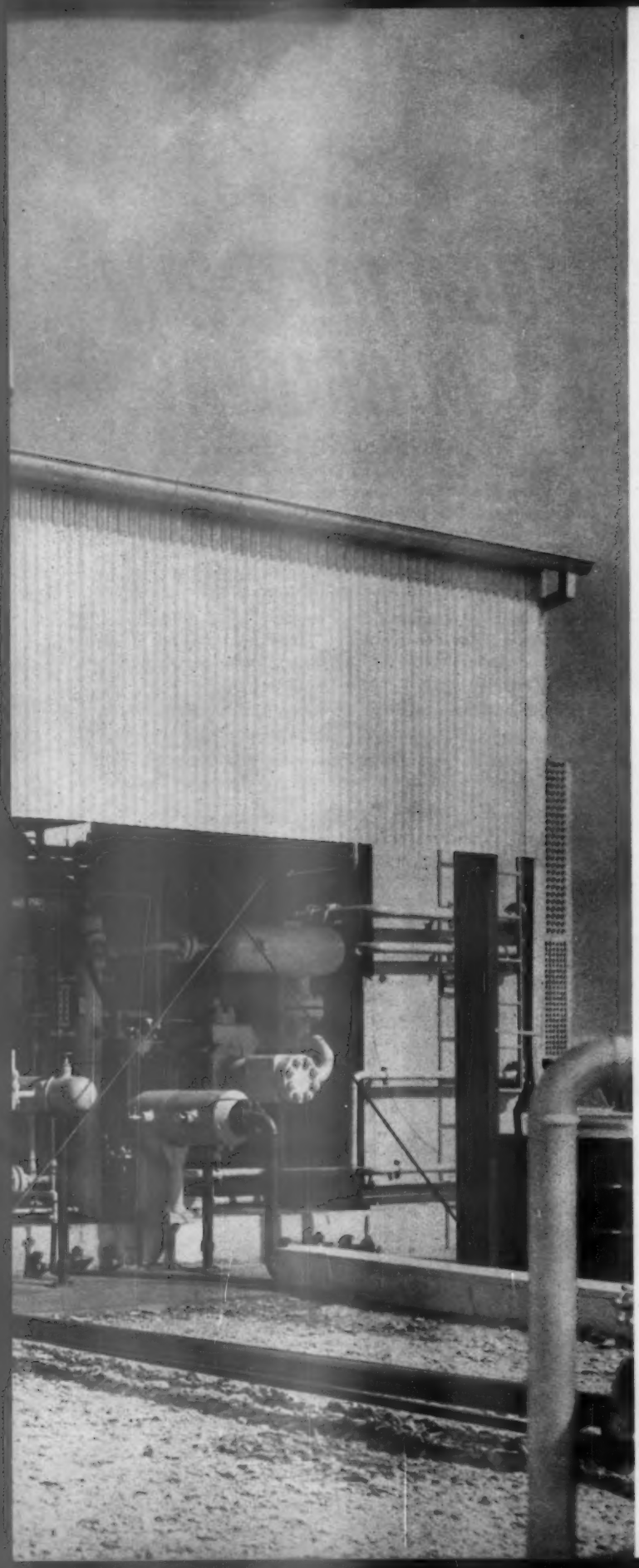

Max Powell, Chief Engineer of Russell Maguire.

FACTS REVEALED ABOUT REMARKABLE ACCEPTANCE OF SLHC

Sales up . . . and up . . . and up. That's part of the history of Worthington's SLHC gas engine-compressor. What is the secret behind this remarkable acceptance?

Listen to Max Powell, Chief Engineer of Russell Maguire, talk about an SLHC on a cycling operation in the Faith-Mag Field,". . . we wanted something that would run all the time—this does . . . we're pleased with it! Take last May, for example. We ran the SLHC unit 734 hours. That's 98.7% operation.

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"No, no one operates it. It's running unattended. Why do we like it? It's getting the job done . . . wish everything did."

When asked about maintenance costs, Mr. Powell didn't know. They were negligible—hadn't been high enough to keep separately on the books.

Mr. Powell didn't mention fuel economy, as some users do. Of all "under 1,000 hp" engine-compressors on the market, the Worthington SLHC is the only one specifically designed for turbo-charging . . . and so operates on up to 21 percent less fuel.

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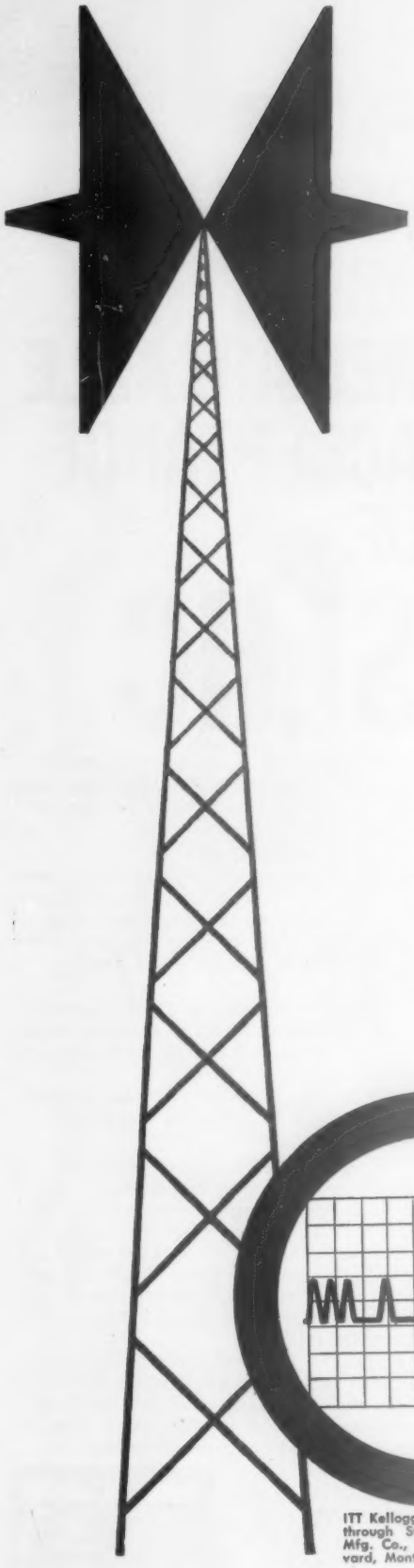

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Yours very truly,

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J. K. Butler

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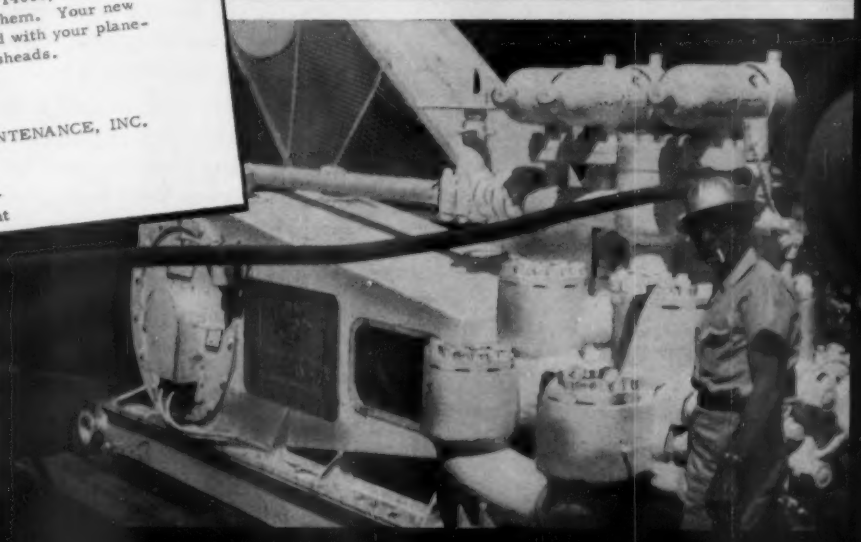

Wheland HP-16000 Planetary Pump owned by Oil Production Maintenance, Inc., on location in the Gulf Coast area.

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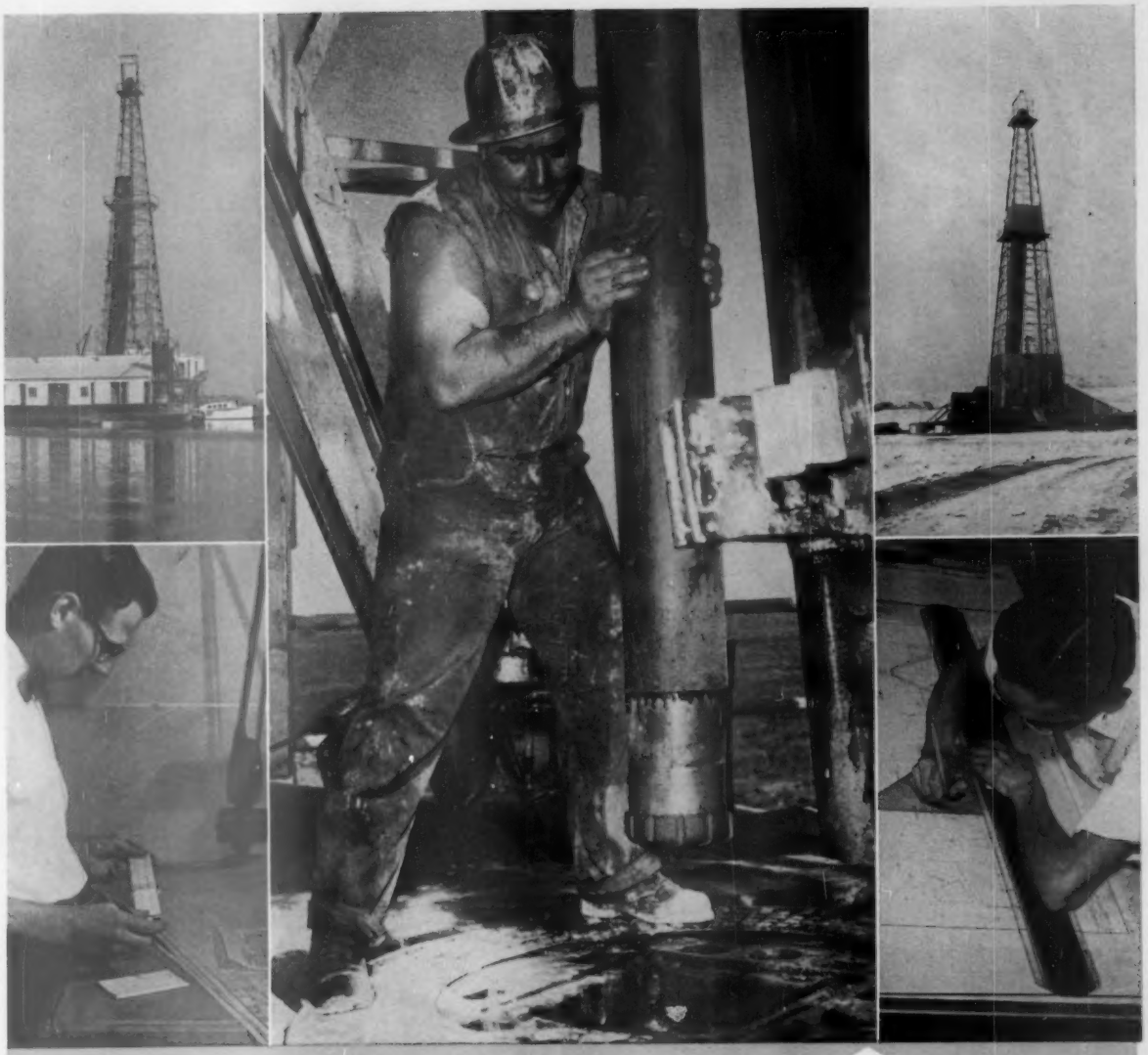

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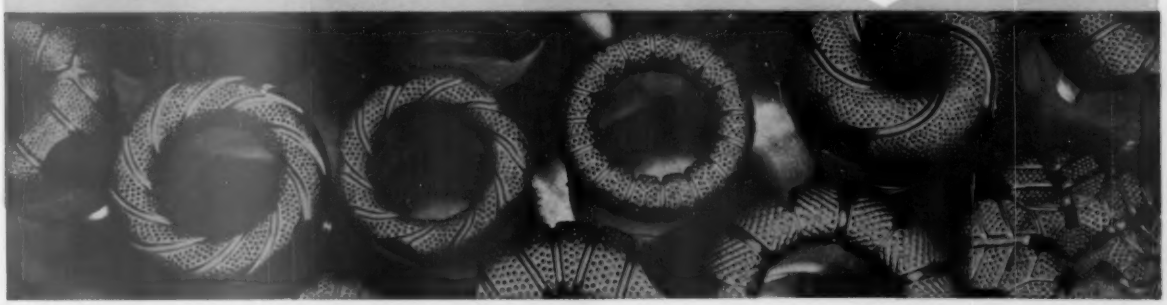

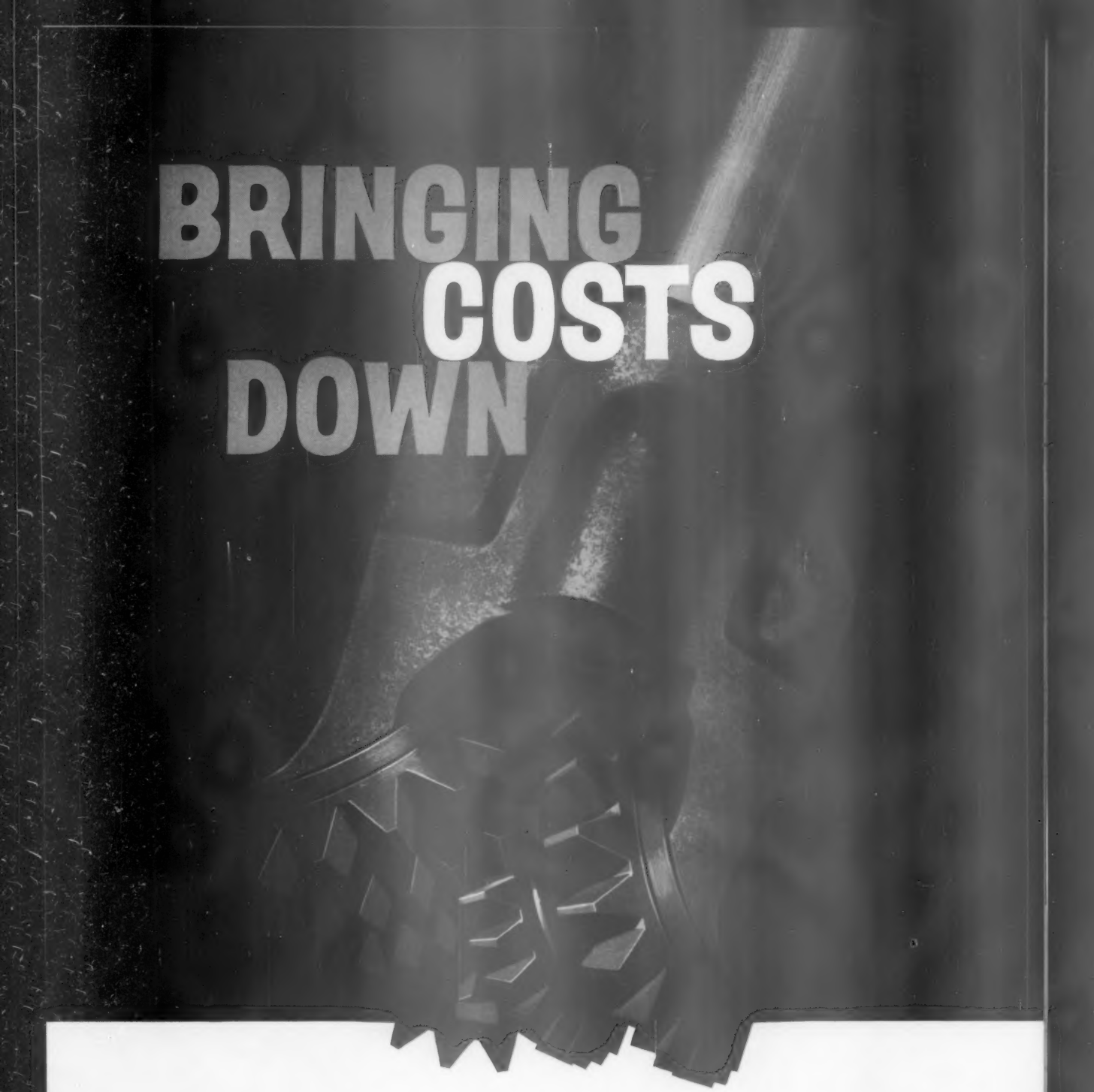

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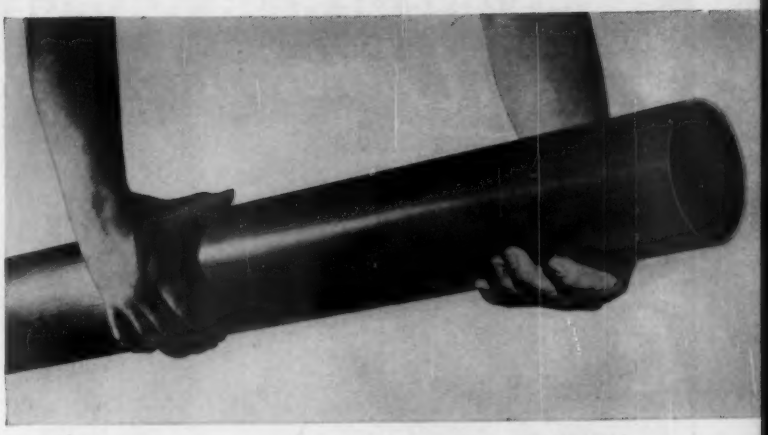

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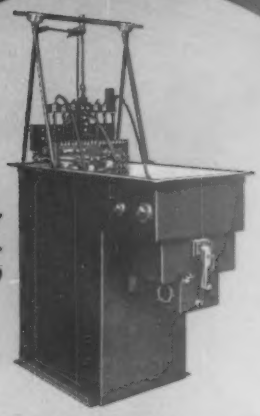

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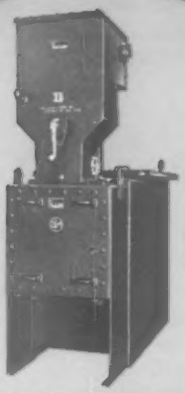
Type AT Combination Starter shown with Contactor and Overload Panel raised above the oil level without disconnecting any bolts or leads—in NEMA 3R enclosure for outdoor mounting, available in 50,000 KVA (certified) interrupting capacity.



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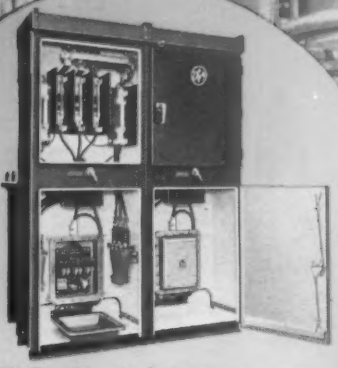

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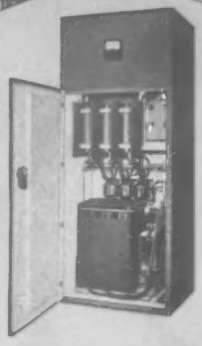

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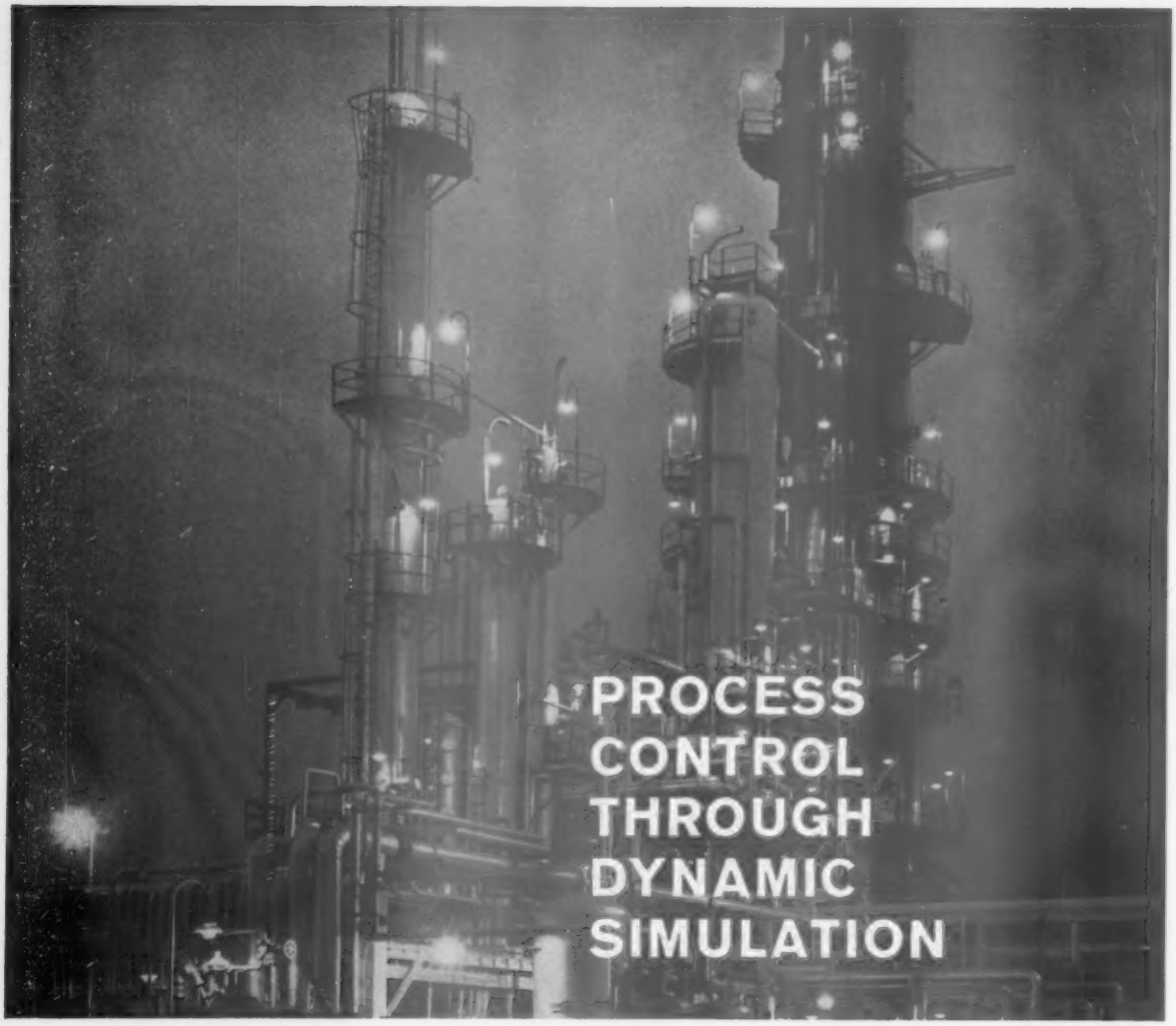

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Short names for long line

Dear Sir:

With reference to your article "Line Into Mexico Needs Short Name," (OGJ, Oct. 24, p. 78) ... how about Tex-Mex, Texical, or Texicali?

Wilson N. Gilliat
Assistant Vice President
Williams Brothers Co.

Mid-America story well told

Dear Sir:

The Journal has done a perfectly marvelous job in telling its readers the story of Mid-America Pipeline (OGJ, Oct. 10, "World's First Major LPG Pipeline," p. 123).

I wanted your organization to know how much we appreciate it. We have heard many favorable comments from readers also.

Robert E. Thomas
President
Mid-America Pipeline Co.

Reactions favorable

Dear Sir:

I'd like to thank you for the extremely interesting treatment you extended our mass flowmeter in the October 3 issue ("Momentum-Change Mass Flowmeter is Practical and Accurate," by G. L. Farrar, p. 90).

Our instrument engineers who have worked closely with this project since its inception have expressed a number of favorable opinions about your coverage, and have asked that their appreciation also be conveyed.

Mark Hopkins, Jr.
Press Relations
Industrial Products
General Electric Co.

Prof's forecast comes true

Dear Sir:

In your September 19, number of The Oil and Gas Journal you have a boxed article entitled "Tunnels Under Field to Tap Pay Above," (p. 65). I am wondering what former student of Prof. E. F. Schramm is the instigator of this secondary-recovery plan.

Over 30 years ago Professor Schramm outlined this very method in his oil geology classes for ultimate recovery of oil. Now that "Prof" is retired it may please him to know that another of his well-grounded predictions is coming true.

I need not mention to any member

NEW FROM OTIS

TYPE BC WIRE LINE BRIDGE PLUG

- Short, compact—less to drill up.
- Small O. D. for easy running.
- Covers wider range of casing weights.
- Can be set with any pressure setting tool.

Here's a casing bridge plug with more plus features than any other plug on the market—yet it costs you no more! It's short and compact—less to drill up—designed to save you up to 50 per cent in rig time when the plug is removed. The Type BC Otis Wire Line Bridge Plug is designed to provide a positive plug, to prevent movement of fluid or gas from either direction in the casing, or to plug and abandon. The Type BC has a small O.D. for ease of running—yet it is designed to set in a wider range of casing weights than any other plug available today.

AVAILABLE THROUGH ANY ELECTRIC LINE SERVICE COMPANY. The Type BC Otis Wire Line Bridge Plug is available through any electric line service company and may be set with any pressure setting tool. Otis bridge plugs are stocked at more than 247 different field locations to make sure they are readily available to the service company of your choice. The next time you need a bridge plug—specify Otis.

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OTIS ENGINEERING CORPORATION
General Offices: 6612 Denton Drive, Dallas
Branches Throughout the Oil Country

of the geologic profession where "Prof" taught, but in case you aren't sure, it was at the University of Nebraska.

I am sorry to have to steal someone's thunder, but in this case you should receive at least 100 similar letters plugging our much-loved and respected "Prof."

Ernest H. Clary
Consulting Engineer-Geologist
Las Vegas.

Consumer would be loser

"An analysis made by IPAA disclosed that without depletion, and assuming exploration were to be carried on at its historic level, the price of gasoline would necessarily increase about 5 cents per gallon.

"So it is not the producer who benefits directly by depletion — he merely puts it back into the ground in search for more oil. It is the consumer who realizes a direct benefit by having available to him an assured and competitive supply."

Alvin C. Hope, president, Independent Petroleum Association of America, in a speech to the New Mexico Petroleum Industries Committee.

Holes in FPC price ruling

"The situation that has prevailed since the Supreme Court decision of 1954 applying the Natural Gas Act to sales of gas to interstate pipelines has been completely unsatisfactory to all concerned because the standards of the act were not designed for producers.

"The recent Federal Power Commission decision at least has the merit of recognizing that the cost of service approach used for gas pipelines is unsound and unworkable for gas producers.

"Unfortunately, the decision leaves many problems unresolved. The area prices announced are unrealistically low. In my opinion, they will not attract the effort required to develop enough supplies to meet increasing demands.

"In addition, the decision overlooks the need for consideration of competitive market values for gas relative to other fuels in order to bring about a balance between demand and supply.

"Finally, the present decision tends to create ceilings which will become increasingly unsatisfactory with time since no standards are set for adjusting the levels in response to future changes in conditions.

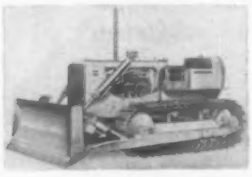
"In the absence of new legislation, the industry will continue to be

WHY GEORGE PEASE USES

D6s for SITE PREPARATION

THIS is one of 60 sites recently prepared by George W. Pease for a large oil company. The location: Osage County, Oklahoma. The job at each site: leveling an area about 85 feet x 130 feet for drilling rig and equipment and digging a slush pit 70 feet square and 5 feet deep. Depending on conditions, it took the Cat D6 Tractor with No. 6S Bulldozer from one to three days to prepare a site.

Why did George Pease choose the D6? An important reason, he'll tell you—"It stands up better than competitive machines." His is no snap judgment, for he's a veteran with 16 years' experience in the business. Ask others like him, who make their living in the same kind of tough work, and you'll hear the same verdict on the D6.



NOW THE NEW D6 SERIES B

Stacked against the previous model—or against any tractor of comparable size—the new D6B is even further out front from every angle: greater production, low-cost operation and time-saving maintenance. Some reasons why:

NEW ENGINE—A Cat D333 Diesel Engine (93 flywheel HP) delivers 25% more lugging ability. New direct-acting governor for quick fuel adjustments handles loads faster.

NEW INTEGRAL HYDRAULIC SYSTEM—Under-the-hood mounting of tank, pump and valves permits convenient routing of hydraulic lines to bulldozer or implement cylinders, frees front and rear for other equipment.

NEW OPERATOR CONVENIENCE—An all-new cockpit has coordinated controls that make the tractor operate almost as if it knew what was needed next.

NEW 8-FOOT BULLDOZER BLADE—This shorter straight blade combines productive capacity with narrow width. No highway permit is required to move machine from job to job.

And that's not all. The new D6B also features dry-type air cleaner, hydraulic track adjusters (optional), lifetime lubricated track rollers, the oil clutch and forward-reverse lever. Get the full details from your Caterpillar Dealer. Ask him to *show* you how the new D6 can step up production on your job!

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U.S.A.

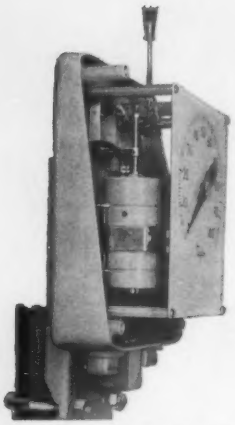
CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

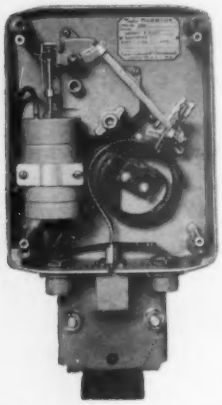
MODERN
HEAVY-DUTY MACHINES
FOR THE HARD WORK

Now... Servo Power in

A high-accuracy, low-cost, motion-balance transmitter for Gage Pressure, Volumetric Pressure, Volumetric Load, Temperature



Diagonally-split case permits calibration adjustments to be made without removing dial.



Single-package pneumatics . . . servo-powered follow-up and relay valve, encapsulated movement and actuating element are easily removable, replaceable.

Taylor's new integrated line of pneumatic transmitters features servo-driven indication as an option on the indicating model. This provides ample power for process alarms—and other auxiliary functions such as digital encoders and potentiometers—with no loss of accuracy in the transmitted signal. Not only does it satisfy today's requirements . . . it provides for possible future needs. Other important features of the TRANSCOPE **210T** include:

- **High accuracy.** Transmitted signal is within ½% of the input signal. Indication is within ±1% of actual value.
- **Exceptional readability.** Big 11¾″ long concentric 270° scale can be read easily at 25-35 ft. Yet case measures only 7″ x 9″ x 4″.
- **Threshold sensitivity.** 0.1% of input span. Low-friction drive mechanism permits accurate handling of low-energy input signals.
- **Designed for easy maintenance.** Only 3 basic parts. A high quality encapsulated motion amplifier; single-packaged pneumatics . . . servo-powered follow-up and relay valve; interchangeable, time-tested actuating elements.
- **Lower inventories.** Benefits large users of instruments by utilizing actuating elements which are common with FULSCOPE® and other Taylor indicating, recording and controlling instruments.
- **Conveniently calibrated.** Diagonally-split case makes all adjustments easily accessible by merely removing cover.
- **Weatherproof case.** Special baked epoxy resin finish on die-cast aluminum case . . . designed for field installation.
- **Adaptable mounting.** Universal bracket permits wall or pipe installation.
- **Non-indicating model (211T)** has same performance as 210T except for process indication.

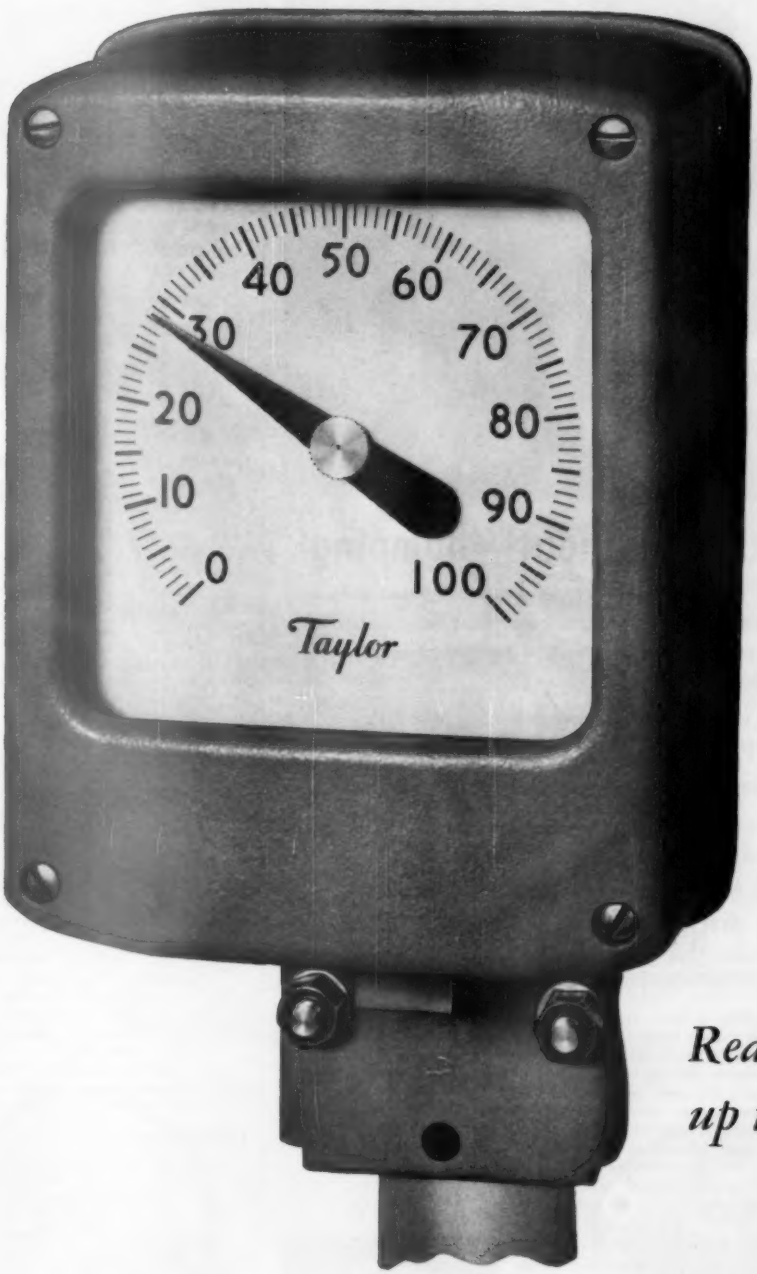
Ask your Taylor Field Engineer for a demonstration, or write for

Bulletin 98385

Taylor Instrument Companies, Rochester, N.Y., or Toronto, Ont.

Taylor Instruments

New Taylor TRANSCOPE® Transmitter



Read it up to 35 ft.!

MEAN ACCURACY FIRST

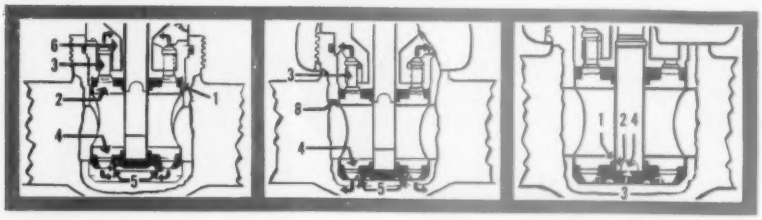
The DEMCO

GATE VALVE

Seals DROP-TIGHT without "bumping"

Positive sealing under the highest line pressures—*with minimum torque*—makes the Demco GATE VALVE your best buy for every mud line application . . . for water flooding, hydra-frac, acidizing and cementing service . . . and for many production applications.

Demco's secret lies in its unique one-unit seal assembly, with its patented spread-ring construction. Here's how it works . . .



A. Resilient seat assembly (1) is reinforced with steel wear rings (2), having integral projecting pins at top (3) and bottom (4). In normal contracted position, the seat assembly is easily inserted in, removed from the body. Until the seat assembly is bottomed, the steel spread ring (5) does not act upon the lower projecting pins, nor do the bonnet legs (6) act upon the upper pins.

B. With the bonnet down and the seat assembly bottomed, the spread ring (5) has forced the lower projecting pins (4) outward. Similarly, the upper pins (3) have been wedged outward by the descending bonnet legs, providing a tight seal between body wall (8) and seat, preventing entrance of abrasives between seat and body wall.

C. As gate is closed, leading edge of gate slides past wear ring (1), contacts rubber ring (2) for positive rubber-to-metal seal. Seal occurs before gate touches rubber cushion (3), eliminating need for "bumping." Relief in bottom of gate (4) allows straddling of solid particles that might interfere with proper closure.

Available at supply stores everywhere in 1,000, 1,500, 2,000, 3,000 and 5,000 psi working pressures . . . in two-, three- and four-inch sizes.

DRILLING EQUIPMENT MANUFACTURING CO.

Oklahoma City, Oklahoma

DRILLING EQUIPMENT MFG. CO. DEMCO OKLAHOMA CITY, OKLA. U.S.A.

plagued with uncertainty for years because of the time required for the courts to review and pass on the policy announced by the commission. Therefore, prompt congressional action is still essential to the public interest. Only such action can define the regulatory standards which will enable gas producers to serve the public efficiently and with assurance as to the price they will be allowed to realize."

Morgan J. Davis, president, Humble Oil & Refining Co., in a speech to the Rocky Mountain Oil and Gas Association.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR OF EVENTS

NOVEMBER

14-16 American Petroleum Institute, fortieth annual meeting, Conrad Hilton, Palmer House and Congress hotels, Chicago.

14-16 Society of Petroleum Engineers of AIME, Venezuelan sections, fourth annual meeting, Maracaibo, Venezuela.

15-16 University of Kansas, natural-gas pipeline institute, Courthouse, Liberal, Kans.

15-16 Purdue University, symposium on engineering applications of random function theory and probability, West Lafayette, Ind.

15-17 Southwest Research Institute, Air Force, Navy, industry propulsion systems lubrications conference, Hilton Hotel, San Antonio, Tex.

18 Natural Gasoline Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.

18-20 Roswell, N. M., Geological Society, field trip, San Andres and North Franklin Mountains, registration November 17, Las Cruces, N. M.

20-22 Fluid Controls Institute, Inc., fall meeting, Drake Hotel, Chicago.

22 Manufacturing Chemists' Association, tenth semiannual meeting and midyear conference, Statler Hilton Hotel, New York City.

27-Dec. 2 American Society of Mechanical Engineers, winter annual meeting, Statler Hilton Hotel, New York City.

DECEMBER

1-3 American Chemical Society, southwest regional meeting, Biltmore Hotel, Oklahoma City.

4-7 American Institute of Chemical Engineers, meeting, Statler Hotel, Washington.

5-7 Interstate Oil Compact Commission, annual meeting, Westward Ho Hotel, Phoenix.

9 Tulane University, School of Law, and American Association of Oilwell Drilling Contractors, fifth annual program on mineral and tidelands law, University Center, Tulane University, New Orleans.

26-31 American Association for the Ad-

GO.... *All the way with* GULFCO!

No matter what your completion requirements, there's quality controlled, forged steel Gulfco well head equipment that will go all the way: from Zero to 15,000 pounds psi working pressure. Gulfco has it, from immediate stock. And . . . Gulfco **SERVICE** goes all the way too.

ASSOCIATION OF WELL HEAD CERTIFIED Equipment MANUFACTURERS

GULF COAST MACHINE & SUPPLY CO. GULF CO TRADE MARK PRODUCTS BEAUMONT, TEXAS.

GULF COAST MACHINE & SUPPLY COMPANY

75 miles from shore--in 40 minutes

Nothing matches Petroleum Helicopters' new Sikorsky S-62 for safe, smooth, fast transport in Gulf offshore oil operations

When the S-62 puts down on the rig's landing platform, it's a case of "love at first flight" with roughnecks and pilots alike. The omniphibious S-62 can operate from land, water, swamp or shipboard. For passenger safety and peace of mind, its sturdy boat hull is indispensable in Gulf flying—even a choppy sea is no problem in water landings.

The dependable turbine engine, quieter than the piston type, packs power to spare. The S-62 can hover and land on the rig's 70-foot-square platform safely and surely, even under adverse conditions. Cruising at over 100 mph, it flies two and a half hours without refueling—for long haul operations, turbine fuel can be safely stored on rigs.

Smooth? Ask any of Petroleum Helicopters' pilots who have flown it! Ease of handling, lack of vibration and low noise level cut fatigue in a flying operation where long hours are the rule.

Work crews, too, are enthusiastic about the speed and comfort of the S-62. No more of those ten-to-twelve-hour boat trips. In little over half an hour, the S-62 puts a new shift on the job—fresh, relaxed, ready for work.

Learn more about the remarkable economies and operating features of this boat-hulled Sikorsky S-62. A note on your letterhead will bring you complete information.

A New World of Mobility by

SIKORSKY AIRCRAFT

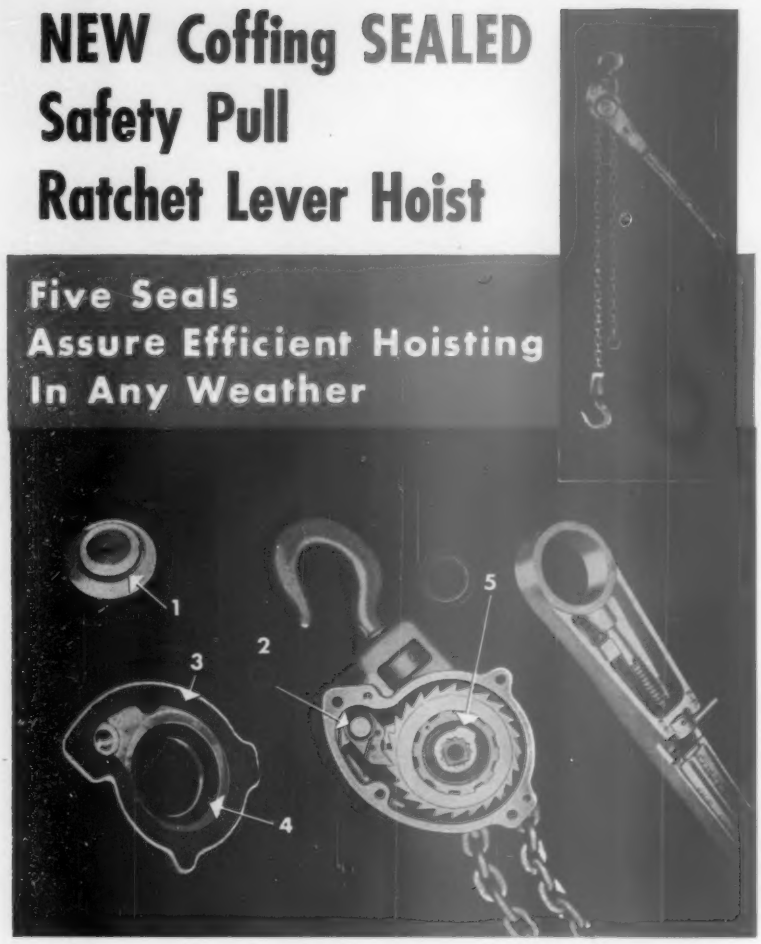
Stratford, Connecticut

A Division of United Aircraft Corporation

SIKORSKY S-62

NEW Coffing SEALED Safety Pull Ratchet Lever Hoist

Five Seals Assure Efficient Hoisting In Any Weather



Here is a new hoist designed for safe, efficient hoisting in any weather. Loads will not slip because the brake mechanism of the Safety Pull Hoist is permanently sealed in five places against moisture, oils, chemicals and dirt—all common causes of hoist slippage.

The spring-loaded Neoprene seals assure that brake performance will remain constant under all exposure conditions. Another advantage of the sealed brake is that it will not freeze or lock—is always free to lower even after accidental overload.

Safety features include the exclusive Safety Handle which bends to indicate overload. The free chain control is protected so that it will not accidentally trip.

The Safety Pull Hoist is easy to operate. The handle pull to lift rated load requires minimum effort. Load spotting is precise to within a fraction of an inch. Up and down controls are away from operator's hand so he can use shorter leverage for greater speed with light loads. Ball bearing swivel load hook and plated chain are additional features.

Five models, ¾, 1½, 3, 4½ and 6-ton capacities are available. For additional information see your favorite supply store or write for Bulletin ADH-78.

COFFING HOISTS

DUFF-NORTON COMPANY

Four Gateway Center · Pittsburgh 22, Pa.

COFFING HOISTS
Ratchet Lever • Air
Hand Chain • Electric

DUFF-NORTON

DUFF-NORTON JACKS
Ratchet • Screw
Hydraulic • Worm Gear

vancement of Science. annual meeting, New York City.

JANUARY

15-18 Pipe Line Contractors Association, annual meeting, Mark Hopkins and Fairmont Hotels, San Francisco.

16-19 Instrument Society of America, winter instrument-automation conference and exhibit, Sheraton-Jefferson Hotel and Kiel Auditorium, St. Louis.

17-19 Kentucky Petroleum Marketers Association, annual meeting and convention, Brown Hotel. Louisville.

18 Institution of Mechanical Engineers (Great Britain), symposium on pressure vessel research toward better design.

20 Natural Gasoline Association of America, Gulf Coast regional meeting, Robert Driscoll Hotel, Corpus Christi, Tex.

24-27 Society of Plastics Engineers, seventeenth annual technical conference, Shoreham Hotel, Washington, D. C.

FEBRUARY

7-8 University of Oklahoma, School of Petroleum Engineering, advanced petroleum engineer seminar, University of Oklahoma, Norman.

18 Purdue University, business history conference, "Management Decisions Under Government Regulation," Memorial Union, Purdue University, Lafayette, Ind.

24 Natural Gasoline Association of America, South Louisiana regional meeting, Lafayette Petroleum Club, Lafayette, La.

26-Mar. 1 American Institute of Chemical Engineers, petrochemical and refining exposition, Municipal Auditorium, New Orleans.

26-Mar. 2 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, Chase and Park Plaza Hotels, St. Louis.

MARCH

1 Institution of Mechanical Engineers (Great Britain), symposium on user experience of large-scale industrial vacuum plant, London.

7-8 University of Oklahoma, School of Geological Engineering, seventh biennial geological symposium, Student Union Building, University of Oklahoma, Norman.

8-10 American Petroleum Institute, Division of Production, southern district meeting, Captain Shreve and Washington-Youree hotels, Shreveport, La.

13-17 National Association of Corrosion Engineers, annual meeting and corrosion show, Hotel Statler, Buffalo, N. Y.

15-17 Natural Gasoline Association of America, annual convention, Baker Hotel, Dallas.

22-24 American Petroleum Institute, Division of Production, southwestern district meeting, Cole Hotel, Albuquerque.

23 National Industrial Conference Board, general session, Shamrock-Hilton Hotel, Houston.

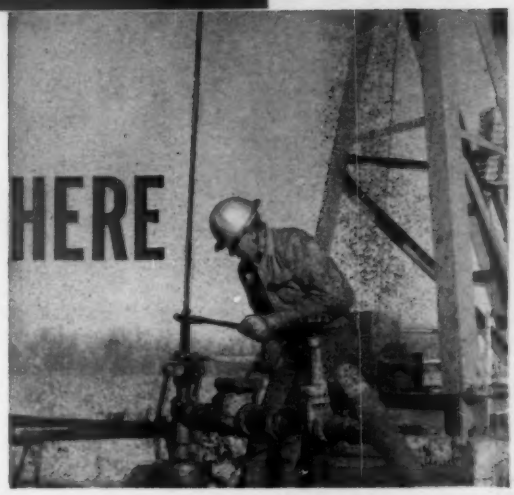
27-29 Midwest Gas Association, annual meeting and convention, Sheraton-Fontenelle Hotel, Omaha.

27-31 Instrument Society of America, symposium on temperature measurement and control in science and industry, Veterans Memorial Auditorium, Columbus, Ohio.

28-29 University of Oklahoma, Schools of Petroleum and Gas Engineering, gas conditioning short course, Oklahoma

WHY SAVE PENNIES HERE

AND LOSE DOLLARS HERE



When a possible saving based on the use of a "cheap" inhibitor is suggested, be sure you appraise the possible "savings" practicably. In the first place, you aren't buying corrosion inhibitors,—you're buying *protection against corrosion damage.* The maximum potential savings which might accrue from the few dollars saved by the purchase of a "cut-rate" inhibitor will never compensate for the over-all cost of a pulling job.

The economy of corrosion control is based on just one factor, continuous, trouble-free production operations. The few dollars more or less spent for proved protection are, in fact, negligible when compared to the total cost of lifting the oil.

Whatever you do, be sure you get all the facts. The Kontol field engineer in your area will be glad to arrange for suitable comparative tests, without cost or obligation. You can then base your inhibitor selection on facts and figures.

KF-60-1

PETROLITE CORPORATION

TRETOLITE COMPANY
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COLOMBIA: South American Petrolite Corporation, Bogota
ENGLAND: Petrolite Limited, 20 Savile Row, London W.1
GERMANY: Petrolite Anlagenbau und Vertriebsgesellschaft m.b.H., Frankfurt a. M.
VENEZUELA: South American Petrolite Corporation, Hotel Avila, Caracas

REPRESENTATIVES

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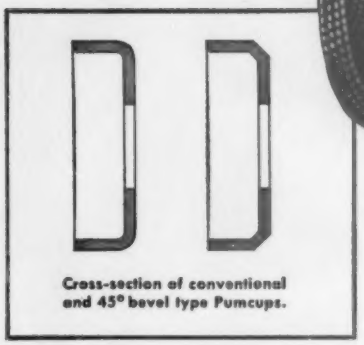
ITALY: NYMCO, S.p.A., 9 Lungotevere A. da Brescia, Rome
JAPAN: Maruwa Bussan KK, No. 3, 2-Chome, Kyobashi, Chuo-Ku, Tokyo
KUWAIT: F. N. Dahdah, Box 1713, Al Kuwait
MEXICO: R. E. Power, Sierra de Mijes No. 125, Mexico, D. F.
NETHERLANDS: F. E. C. Jenkins, Hoefbladlaan 134, The Hague
PERU: Oilfield Import, S. A., Apartado 71, Talara
TRINIDAD: Neal and Massy, Ltd., P. O. Box 544, Port of Spain

2-way gain with PUMCUPS



Cross-section of conventional and 45° bevel type Pumcups.

Darcova Pumcups are available in various types and textures, in a complete range of sizes, to provide unequalled efficiency and long life in reciprocating pumps, air or hydraulic mechanisms.

★ prolonged high efficiency
★ less maintenance

TODAY hundreds of companies using hydraulic controls, air cylinders or reciprocating pumps are *standardizing* on Darcova Pumcups for piston packing, because they eliminate fluid slippage, costly down-time and maintenance.

Darcova Pumcups make the *most* of the cup packing principle. And, they are made in a complete range of sizes, types and texture-engineered compositions for various pressure-temperature-fluid conditions. Pumcups hold peak efficiency for the life of the cups and outlast other packing as much as 3 to 1.

Why not check these claims right in your own plant? Meanwhile get *all* the facts. Just send for Pumcup Bulletin No. 5903.

DARLING VALVE & MANUFACTURING CO.
Williamsport 1, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP
TRADE MARK
PUMCUPS

Memorial Union Building, University of Oklahoma, Norman.

APRIL

5-7 American Petroleum Institute, Division of Production, Mid-Continent district meeting, Mayo Hotel, Tulsa.

6-7 University of Oklahoma, School of Mechanical Engineering, short course on industrial engines, University of Oklahoma, Norman.

9-12 Western Petroleum Refiners Association, annual meeting, San Antonio, Tex.

9-13 American Society of Mechanical Engineers, oil and gas power conference and exhibit, Jung Hotel, New Orleans.

10-11 American Society of Mechanical Engineers, maintenance and plant engineering conference, Bancroft Hotel, Worcester, Mass.

17-19 Instrument Society of America, symposium on instrumental methods of analysis, Shamrock-Hilton Hotel, Houston.

18-20 University of Oklahoma, southwestern gas measurement short course, North Campus, University of Oklahoma, Norman.

19-21 National Petroleum Association, semiannual meeting, Hotel Cleveland, Cleveland.

20-21 Society of Petroleum Engineers of AIME, East Texas-Louisiana-Arkansas gas-technology symposium, Tyler, Tex.

24-26 Southern Gas Association, meeting, New Orleans.

24-27 American Association of Petroleum Geologists, Society of Economic Paleontologists, and Rocky Mountain section of AAPG, annual meeting, Denver Hilton Hotel, Denver.

26-28 American Petroleum Institute, Division of Transportation, pipeline conference, Chase-Park Plaza Hotel, St. Louis.

28 Natural Gasoline Association of America, Oklahoma regional meeting, Lake Murray Lodge, Ardmore, Okla.

MAY

3-5 American Petroleum Institute, Division of Production, Rocky Mountain district meeting, Gladstone-Henning Hotel, Casper, Wyo.

4-5 Society of Petroleum Engineers of AIME, oil recovery conference, Midland, Tex.

4-5 Pacific Coast Gas Association, Inc., transmission conference, Biltmore Hotel, Santa Barbara, Calif.

7-10 American Institute of Chemical Engineers, meeting, Sheraton-Cleveland Hotel, Cleveland.

8-11 American Petroleum Institute, Division of Refining, midyear meeting, Rice Hotel, Houston.

9-11 Western Joint Computer Conference and Exhibit, Ambassador Hotel, Los Angeles.

10-12 American Society of Mechanical Engineers, production engineering conference, Royal York Hotel, Toronto.

11-12 American Petroleum Institute, Division of Production, Pacific Coast district meeting, Biltmore Hotel, Los Angeles.

16-19 American Petroleum Institute, Division of Marketing, midyear meeting, Americana Hotel, Miami Beach.

19 Natural Gasoline Association of America, Permian Basin regional meeting, Lincoln Hotel, Odessa, Tex.

21-24 American Petroleum Institute, Division of Transportation, midyear highway conference, Bellevue Stratford Hotel, Philadelphia.

FREE SAMPLE

NEW ALL-WEATHER "SCOTCHRAP" BRAND PIPE PROTECTION TAPE NO. 40

Now—an all-season tape that handles the toughest jobs. Ideal for field-wrapping under cold weather and other adverse climatic conditions. Provides excellent insulation properties and improved electric strength; resists acids, alkalies, salts, oils, gasoline and naphtha. Try it yourself and see . . . send in the coupon below for your free 9-foot sample roll.

----------SEND IN TODAY----------

3M Co., Dept. EAK-110, 900 Bush Ave., St. Paul 6, Minn.

Send me my free sample roll of your new all-weather "SCOTCHRAP" BRAND Pipe Protection Tape No. 40.

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COMPANY_____

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ELECTRICAL PRODUCTS DIVISION

MINNESOTA MINING AND MANUFACTURING COMPANY

3M COMPANY

. . . WHERE RESEARCH IS THE KEY TO TOMORROW

"SCOTCHRAP" IS A REGISTERED TRADEMARK OF 3M CO., ST. PAUL 6, MINN. EXPORT: 99 PARK AVE., NEW YORK 16. CANADA: LONDON, ONTARIO.

HERE'S THE BIT
THAT WILL CHANGE
YOUR MIND!

FASTER PENETRATION
FULL GAGE HOLE--

The new Reed Y bits have changed the concept of how fast a hole should be drilled. These Y bits have been setting impressive records in fast drilling all over the oil country. Advanced design, using special alloy steels combined with precision manufacturing, provides maximum rate of penetration—in a straight, full gage hole.

The ability to hold gage is a built-in feature in every Reed bit you buy. Continuing research, hard hitting engineering, modern metallurgy, and forty-two years experience have developed a bit that will hold gage all the way.

Ask the Reed man who calls on you to give you the full story. He'll convince you that the bit to buy—if you want faster penetration and a full gage hole—is the modern Reed Y bit.

REED ROLLER BIT COMPANY *Houston 1, Texas*

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REED

REED'S ROLLIN'

REED [illegible] BITS

. . . and this is just the beginning!

NOW - THE SOLUTION TO INTERNAL JOINT CORROSION!

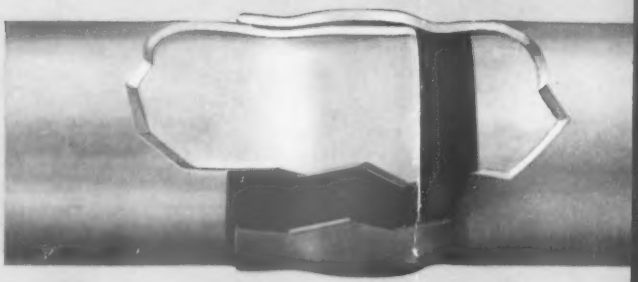
New SERIES 500 Epoxy-Joined Line Pipe

Radically new SERIES 500 epoxy-joined steel pipe eliminates costly, time-consuming welding operations and provides a rapid, low-cost method of joining line pipe. *More importantly,* it finally provides the answer to joining line pipe without the danger of corrosion at every joint.

SERIES 500 pipe is flared to a bell shape on one end to receive the plain end of another pipe length. Contact surfaces are coated with an epoxy adhesive before they are joined. A patented tool then crimps the joint, providing mechanical strength while the epoxy sets. The pipe can be laid immediately.

Field tests over a 12-month period have proved the advantages of this new method. It has joined line pipe rapidly and permanently, providing a plastic-lined joint that *prevented internal joint corrosion.* The high-strength, lightwall pipe has substantially reduced material costs. Installation time and costs have also been reduced because welding operations were eliminated.

Recently SERIES 500 pipe was used to lay a 20,000-foot, 4-inch gas line. Pipe costs were 58 per cent lower than the cost of conventional pipe. Installation costs were also reduced 25 per cent and installation time was about half that required for welded-joint pipe.

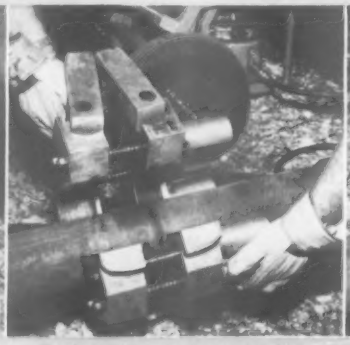


Internal construction of SERIES 500 pipe joints is strong and simple. The internal epoxy coating prevents joint corrosion.

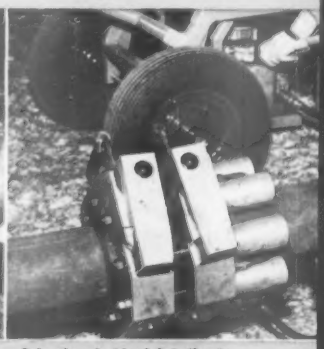
Tex-Tube manufactures the new SERIES 500 pipe in sizes from 1½ to 4½ inches. Present working pressures are 1200 psi for pipe from 1½ through 3½ inches and 800 psi for larger pipe. Research is expected to increase future working pressures to the yield strength of the pipe.

First the plain-pipe end is coated with epoxy adhesive.

Next the inside of the bell-shaped end is coated with epoxy.



The hydraulic crimping tool is then placed around the joint.



Crimping holds joint firmly while epoxy sets. Pipe can be laid immediately.

PIPE MANUFACTURERS

High Tensile Lightwall Pipe
Oil Well Casing
Oil Well Tubing
Structural and Mechanical Tubing
Shot Hole Casing
Upsetting, Threading, Normalizing

DISTRIBUTORS

Oil Country Goods
Line Pipe
Refinery and Chemical Plant Piping

TEX-TUBE, INC.

1503 NORTH POST OAK ROAD • HOUSTON, TEXAS
Sales Offices in Midland, Dallas, Amarillo, Tulsa, Los Angeles and Pensacola

the Journal said...

50 years ago

November 17, 1910

New drilling getting under way in the San Juan fields (Mexican Hat) of southeastern Utah makes this one of the most active spots in the country. Twenty drills now are working in the area, seven more are being moved in, and more than a dozen additional locations have been made. Eleven wells have been completed with daily oil production of 3,000 bbl. Producing depths range from 475 to 1,400 ft.

Everyone in Midway district of California turns out with teams and shovels to throw up dikes to hold the oil from Midway-Premier Oil Co.'s new giant gusher flowing an estimated 40,000 bbl. daily. The 22°-gravity crude is the first large production in the Midway area.

Major buyers boost price of Oklahoma, Kansas, and Caddo (Northwest Louisiana) crudes 2 cents to new posting of 42 cents per barrel.

25 years ago

November 14, 1935

New gas-condensate well in Cayuga field opens first Trinity (Lower Cretaceous) production in East Texas. Operators battle high pressures (2,700 psi.) to control flow from sand at 7,210-7,300 ft. Total depth of 9,085 ft. sets new drilling-depth record for East Texas.

Michigan's biggest gas well, drilled by Michigan Exploration Co. in Belvidere Township, Montcalm County, flows 40 M.M.c.f. daily from stray sand at 1,215 ft.

President Axtell J. Byles, at sixteenth annual convention of American Petroleum Institute in Los Angeles, cautions gathering against "scare of scarcity" being used by "false prophets" to frighten country into federal control of oil industry. Evidence points, he said, to adequate supply of petroleum products for many generations.

10 years ago

November 16, 1950

Columbian Carbon Co. brings in Maryland's first sizable gas well in wildcat discovery on Deer Park structure, in southwestern Garrett County. No. 1 Welch well flows 8,029 M.c.f. daily with rock pressure of 1,610 psi. from Huntsville chert at 2,835-69 ft.

California Natural Gas Association commemorates twenty-fifth anniversary of its organization at annual meeting in Los Angeles with review of industry's technical advances.

JOURNALLY SPEAKING

ROBUST HOLLANDERS, who know what's good, swallow fresh, raw fish head first during "herring break" at Dutch refinery. The herring aficionados might have suggestion for sardine troubles at affiliated refinery on Bahrain Island. But the question is: Will Bahrain refiners swallow the idea?

Refiners' fish problem . . .

ANYBODY who ever sat behind a fishpole waiting patiently for a perch or catfish to take the bait may appreciate the jobs and woes fish bring to some of his fellow oil men.

Take the woes first. Refiners at the big Caltex refinery on Bahrain Island are periodically beleaguered by too many fish. This may sound incredible to a Saturday afternoon bluegill enthusiast. But it's true.

For years, vast shoals of jellyfish or prawn, a member of the shrimp family, have invaded the sea-water intake area of the 186,500-bbl. plant. They clog the intake screens at the pump houses, and imperil the cooling system.

This year, "manchusee", an edible sardine-sized fish, caused the trouble. Thousands ganged up and rushed against the intake screens. The services of commercial fishermen were required to keep the onrushing fish from blocking the system or causing damage.

The fishermen, who use manchusee as bait, netted hundreds of fish from the system.

Nobody knows for sure what causes the invasions. One theory is the fish in one way or another are weakened and cannot hold themselves back from the suction power of the pumps. Another explanation is the fish may have been herded in by larger fish coming in from deeper water.

Now take the joys fish bring to some oil people. Probably nobody enjoys a nice raw herring fresh from the North Sea like a Dutchman, including those employed at another Caltex refinery, in the Netherlands.

The Caltex Pernis plant takes a "herring" break instead of a coffee break when fishing boats come into port with a catch. The fish are sold from small open carts in the wharf area, where the plant is located, and refinery workers eagerly smack their lips while waiting to down the snack head first.

But the herring break is nothing so new as the coffee break. Ancestors of Caltex workers have enjoyed downing raw herring for hundreds of years. The custom is especially popular when the boats come in for the first time in spring.

The obvious conclusion is that with the widespread exchange of ideas within an affiliated group of companies, Caltex Dutch employes may have some suggestions about how Bahrain refineries may take care of some of their sardines.

We won't make the suggestion ourselves. The Bahrain crew might thank us by sending a few fish, and just happen to forget to pack in the ice.

—Ray Gibson,
New York

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RESOURCES
of production . . .
of transportation
. . . of storage

plus Warren
EXPERIENCE
as a specialist
in its field . . .

form a
completely dependable
ABILITY
team.

That is why the Light Hydrocarbons Industry . . . natural gasoline and LP-Gas . . . Naturally looks to Warren

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PETROLEUM CORPORATION

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EXPORT TERMINALS: CORPUS CHRISTI, PORT ARTHUR, BAYTOWN, TEXAS CITY AND WARRENGAS, HOUSTON, TEXAS, SAN PEDRO, CALIF.

How to soar with the Sixties

LAST JANUARY the oil industry greeted with high hopes the advent of what the forecasters euphemistically called the "Soaring Sixties." Everybody seemed to think this would be a gravy-train decade.

So far it isn't. What's wrong? Does the fault lie with the times themselves? Or with our failure to recognize today's challenges?

One thing is certain: The Sixties will be different from the Fifties and the Forties and the Thirties. The uncertainty is whether the oil industry will also be different and whether its differences will dovetail into the changing times.

THE RESPONSIBILITY OF MANAGEMENT is to foresee trends and to keep the company in the forefront of them. The oil industry needs leaders who will live up to the definition of leadership by boldly getting out in front and hewing a path for the rest.

To adapt the industry to the conditions of the Sixties is going to take a lot of imaginative pioneering—considerably more than is in evidence today in spite of the efforts of a few individuals.

We need to shake ourselves loose from old methods of doing things, old standards of accomplishment, and particularly old habits of thinking.

During the past generation the oil industry was preoccupied with discovering and applying scientific knowledge of the occurrence and reservoir behavior of oil and gas and of processing petroleum into useful products. Industry leadership went to those who could produce more and better.

The need of the Sixties is to apply the same degree of scientific inquiry and management know-how to such realms as economics, customer relationships, and governmental affairs.

As examples, entirely new approaches are needed—

- In public affairs: to devise gas-price regulation that all can live under instead of the bullheaded stalemate of obsolete concepts.
- In production: to replace outmoded legal and operating precedents with an application of the mass-production principle so that fields can be operated with the fewest number of wells.
- In marketing: to restore consumer acceptance of oil heating; to reduce the causes of price wars; to eliminate uneconomic distribution.

OIL IS A FOSSIL-FUEL INDUSTRY, but let's keep the hyphen in there and not become a fossil industry. Fossils belong in the ground, not in swivel chairs.

The entire industry must make a vigorous effort to shake off provincialism, complacency, obstinacy, convention, and other obstacles that hold back experimentation with new ideas in fields other than technical.

Forget the old, think bold—that's how to soar with the Sixties.

A TALE OF TWO FLOODS

HOW TWO WATERFLOOD OPERATORS INCREASED

CASE NUMBER ONE

This major oil company, operating a shallow waterflood unit, was experiencing severe declines in some producing wells.

In 1956, five wells were fractured. Production increases were so encouraging that the fracturing program was continued. Results have been analyzed only through 1958, but recent experiences have been at least as good or better than earlier results.

During the three years under study, 52 producing wells were fractured by Dowell and 6-month tests were obtained.

Production before fracturing averaged 2.1 bopd for all 52 wells. Six months after fracturing, production averaged 19.5 bopd—an average increase of 17.4 bopd or a percentage increase of about 930 per cent.

In addition to the producing wells, many injection wells were also fractured so that increasing volumes of water could be handled with a minimum addition of wells and pumping equipment.

Three-month reports are available on 20 such injection wells. Before fracturing, the wells would take an average of 44 bwpd at line pressure. Three months after fracturing, they would take an average of 202 bwpd—a 4.6-fold increase.

No exact monetary value can be placed on this increase, but it is obvious that the system could handle more water without increases in equipment and power requirements.

CASE NUMBER TWO

This independent operator started flooding a Bartlesville sand pool that had been abandoned. The field was originally opened up in 1917 and had been depleted by primary methods.

Early in the flood, the operator found that conventional five-spot flooding of the central part of the pool did not yield economical production. A general policy was developed to inject water in the central part and drill producing wells around the periphery.

Apparently there was still considerable oil in place along the edges, but the relatively tight formation prevented profitable producing rates without fracturing.

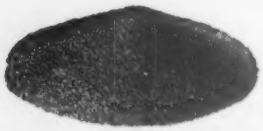
In 1952, the first two fracturing treatments were performed. Results were so encouraging that a systematic program of drilling and fracturing was started. By

THE STORY AT A GLANCE

- Location — **Eastern Kansas**
- Operated by — **a major oil company**
- Number of fracture treatments — **52**
- Average production per well before fracturing — **2.1 bopd**
- Average production per well **six months** after fracturing — **19.5 bopd**
- Average per cent increase in production — **930 per cent**
- Approximate cost of all treatments — **$27,000**

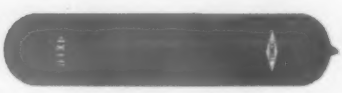
MORE IDEAS FROM DOWELL

TO HELP INCREASE PROFITS FROM SECONDARY RECOVERY



MAGNESIUM PELLETS

are often pumped into the formation before acidizing to heat the acid and melt away heavy hydrocarbons that might be blocking either injection or production. These treatments have proved remarkably successful.



ROCKSHOCK®

(Implosive formation treating service) is proving valuable both for formation cleaning and fracture initiation. It often makes possible the fracturing of formations that could not otherwise be fractured.

EZEFLO®

is a new Dowell surfactant. Available in bulk, it is especially useful for lowering water injection pressure. It is suitable for any use where an efficient, concentrated nonionic surfactant is indicated.

PROFITS WITH DOWELL STIMULATION SERVICES

THE STORY AT A GLANCE

- Location — **Eastern Kansas**
- Operated by — **an independent producer**
- Field had been abandoned before waterflood started
- Number of fracture treatments — **34**
- Cumulative production from fractured wells* — **866,512 barrels**
- Cost of fracturing* — **$25,828**
- Fracturing cost per barrel of oil — **3 cents**
- Fracturing cost as a percentage of total production cost — **less than two per cent**

*to December 31, 1959.

the end of 1959, 34 frac jobs had been performed at a total cost of approximately $25,828. All but a few of the earlier jobs were performed by Dowell.

Fracturing fluids, sizes of jobs and techniques were modernized and improved, as the program continued, to assure the operator of the greatest possible return on his investment.

Cumulative production from these wells totaled 866,512 barrels by the end of 1959. The net sales price of the oil was in excess of two million dollars. Cost of the fracturing treatments amounted to 3 cents per barrel of oil produced or less than two per cent of the total cost of producing the oil.

For this two per cent, the operator changed a flood that was headed for economic failure into an excellent financial success.

These field studies are just two more examples of how Dowell services can help operators improve production, keep down costs, improve profits and speed payout on investment.

You may run into a wide variety of problems in addition to oil production when you operate water disposal, gas injection or waterflood facilities. Your Dowell representative has a wide variety of services and products—both new and old—to help you solve your problems. A few examples are noted in the box below.

In addition to those services mentioned here, Dowell offers the Frac Guide*, the Acid Guide*, Cealment*, Corban* and Freflo* to help solve problems of secondary recovery. For more information on how Dowell can help you increase profits from your secondary recovery, pressure maintenance, water disposal or gas injection projects, **dial Dowell.** Dowell services and products are available from more than 150 offices and stations in the United States, Canada, Venezuela, Argentina and Germany. Dowell, Tulsa 1, Oklahoma. *Dowell Trademark

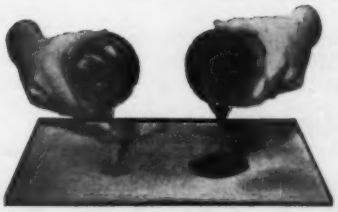
Services for the oil industry

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

ABRASIJET*

(Dowell-developed abrasive jetting service) can be used to initiate fractures, perforate or clean the formation face. On injection or disposal wells the result is often a good increase in receptibility and/or a lower injection pressure. On producing wells, the results have been higher production, better gas/oil or oil/water ratios or improved results from fracturing or acidizing.



STABILIZED ACID

is regular acid with a special addition agent to prevent the deposition of gummy iron or aluminum hydroxides which might otherwise plug formation pores.

GYPBAN*

is a Dowell agent that is used to prevent formation plugging by water-formed gyp deposits. It is oil-insoluble and dissolves only gradually in water, thus providing months-long protection.

No joint leakage...no creep with AMERICAN IRON Straight Grip Tool Joints!

No worry about joint leakage or creep with our 4 POINT SEAL PROTECTION . . . in fact, the seal actually becomes TIGHTER as the tension load and pump pressure are increased.

AMERICAN IRON Straight Grip tool joints are *three times* as strong as the pipe they connect! You'll like the quick, easy way this hand applied Straight Grip can be removed and installed right at the rig. STRAIGHT GRIP tool joints are ideal for handling high tensile drill pipe.

These are just a few of the reasons why you buy quality when you specify AMERICAN IRON.

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President-Elect John F. Kennedy
. . . Neither friend nor enemy at the moment.

Vice President-Elect Lyndon B. Johnson
. . . He'll still carry a lot of weight in Congress.

How the Election Will Affect Oil

- The new administration will be neither pro-oil nor strongly anti-oil, but the industry will find the going rough until new, key appointees learn their way around. It calls for vigilance and better Washington relations.

- Some early indications: No change in depletion through 1961, no big push soon for a fuels-policy study, the status quo in heads of major committees of Congress, less harmful sniping between Congress and the administration.

Clyde La Motte
Washington Editor

THE OIL INDUSTRY has its work cut out for it in Washington.

The job, basically, is one of retelling oil's story so that new government officials who act on oil issues will have the proper facts and background on which to base their decisions.

The election of John F. Kennedy to the presidency means there will be sweeping changes in top-level administrative personnel, putting new government people in key roles.

There will be a period of some uncertainty during the transitory period until oil policies of the new Administration become more clear-cut.

And, equally important, there will be uncertainty until the new officials — whatever their leaning — become acquainted with their roles and the problems they will face.

Such a reshuffle occurs, of course, any time a new president takes office, particularly when a change in party is involved. But the transition is becoming more and more significant to the oil industry because of the growing involvement of the executive branch in oil problems.

The impact of government actions on industry operations simply adds emphasis to the need for alert, aggressive oil representation in the nation's capital.

There has been an increase in the industry's Washington representation in recent years, especially during the past 2 when many firms either opened offices in Washington or increased staffs already assigned there.

There have been indications that this increased representation has pro-

Due for Replacement . . .

Robert Bicks
. . . Assistant Attorney General and top figure in antitrust matters.

Fred Seaton
. . . Well-informed Interior Secretary who campaigned for Nixon.

Elmer Bennett
. . . Understanding Undersecretary of Interior and key imports figure.

Friends in Key Spots . . .

Rep. Oren Harris
. . . Chairman of the Interstate and Foreign Commerce committee and a key figure in gas legislation.

Rep. Wilbur Mills
. . . Chairman of Ways and Means and the Joint Committee on Internal Revenue Taxation. Depletion report due in '61.

Rep. Frank Ikard
. . . One of the best informed on oil. He'll be back in the House, unless he should seek to succeed Lyndon Johnson.

Enemies Who'll Be Back . . .

Sen. Estes Kefauver
. . . He dislikes oil's marketing practices, favors divorcement.

Sen. John J. Williams
. . . Principal leader in the continuing battle to whittle depletion.

Sen. Paul Douglas
. . . Constant critic and supporter of legislation detrimental to oil.

duced some good results, with the oil climate in Washington showing signs of gradual improvement.

Now a considerable amount of that work will have to be redone as new people move into government posts that will give them control of such issues as the level of crude oil and residual fuel oil imports, oil-price surveillance and a host of other oil matters.

Had Richard Nixon won, the job would have been simpler because changes by Nixon in policies and men would have been more gradual than Kennedy's are likely to be.

1. The Kennedy approach

There is little reason to believe that the President-elect will advocate an anti-oil policy.

It is true that he once voted against a natural-gas bill, and he voted for a graduated cut in percentage depletion. Also, he is committed to a fuel-policy study and to a review of tax measures affecting the oil industry.

Furthermore, he took a much less definite stand on such oil issues as percentage depletion and gas legislation during the campaign than Nixon did. So the industry naturally is less certain just where Kennedy stands.

However, it should be borne in mind that he did not play a key role in opposing the natural-gas bill nor in advocating a reduction in percentage depletion when those issues were before Congress. In fact, he once voted against a flat cut in depletion to 15%.

More important, however, is that Kennedy appears at this time to have a relatively open mind on these questions.

He emphasized during the campaign that his advocacy of a study of taxes did not necessarily mean that he would favor any reduction in percentage depletion — particularly not for the domestic producer. He did not even rule out the possibility of an increase in the percentage if a study shows that was necessary to provide an adequate supply of domestic oil.

What it adds up to, then, is this: There will be no change in percentage depletion under the Kennedy Administration until after a careful study is made. This would give the industry an opportunity to justify the tax provision through normal congressional proceedings. And in the past the industry has always been able to do this.

So the threat of any major assault on percentage depletion appears to be a dim one, at least in 1961.

The possibility of a fuel-policy study appears to have more inherent

danger over the long run because it could mean government interference with the normal development of the nation's natural resources.

Here again, however, there is no indication that Kennedy will press for hurried action.

All in all, one can conclude that the impact of a Kennedy Administration on the industry will be an indirect one for the most part.

And it is far too early to predict the course of these actions or to weigh their effect.

2. Regulatory agencies

The most important early moves the new President will take affecting the oil industry directly will be the appointments he makes to the regulatory agencies and to administrative posts.

Consider the regulation of oil imports. New men will replace Interior Secretary Fred Seaton and, quite likely, Under Secretary Elmer Bennett—both of whom have shown an increasing knowledge and understanding of the oil problems involved.

Bear in mind, too, that the President will be able to appoint a new majority at the Federal Power Commission and the Federal Trade Commission next year. This will have a direct bearing on natural-gas regulation and antitrust law enforcement. It could mean a change in the current regulatory course.

In the Justice Department, there will likely be a replacement for Robert Bicks, who has concentrated largely on antimerger actions. And certainly there will be a new attorney general.

There will be changes, too, at the Department of State, and this could be of far-reaching importance to oil because it is quite likely that oil—both at home and abroad—is going to become more and more involved in broad international issues.

Clearly, this government's growing involvement in oil issues is likely to spread increasingly to foreign-oil operations by U. S. firms.

And, because new men will be in the driver's seat on both foreign and domestic issues, the upcoming personnel changes are important.

There is no reason to fear that the new President will choose men for key government oil roles who have an anti-oil attitude.

But the point worth emphasizing is that whatever the caliber or the philosophy of the new government official, it will be necessary for him to learn his job.

That is why the industry must be prepared more than ever to present its case adequately.

At the FPC, for example, the present commission majority has made progress toward common-sense regulation of natural-gas producers, yet it took years for producers to get their points across.

Now, with three new commissioners likely to be named by mid-1961, producers cannot assume that the new commission majority will have the knowledge or the viewpoint of the current majority. It could differ greatly.

However, there can be a bright side to the changes that are made when a new administration takes over at the White House.

For one thing, the President and the majority in Congress in 1961 will be of the same party. This should tend to reduce the sniping between the two branches of government that frequently results when the control is split.

Many Washington observers are convinced, for example, that the Tulsa "conspiracy" case came about largely because a Democratic-controlled congressional committee wanted to show that the Republican Administration was "soft" on big business.

3. A look at Congress

The election had little effect on the membership of Congress or on its direction.

The Republicans made slight gains in both the Senate and the House, but are still far short of a majority.

Over-all, it is likely that a coalition of Republicans and conservative Democrats will continue to hold the upper hand in Congress, perhaps even more so than in the past.

There will be a new Senate majority leader when Lyndon Johnson resigns as senator to be sworn in as vice president. His successor is not definite at this time—although Sen. Mike Mansfield of Montana is the best bet—but it is certain that he will not veer sharply from the pattern Johnson had set.

At any rate, the majority leader's role is less important when the President and the Senate majority are of the same party. Furthermore, there is considerable speculation that Johnson will continue to wield a great deal of weight in Congress.

In the House, Rep. Sam Rayburn of Texas will continue as speaker.

For the most part, the chairmanships of the key congressional committees will continue to remain in the same hands.

This will mean that Rep. Howard Smith of Virginia, a conservative Democrat, will continue as chairman of the powerful House Rules Committee.

Rep. Wilbur Mills of Arkansas, who works closely with Rayburn, will continue as chairman of the influential Ways and Means Committee and the important Joint Committee on Internal Revenue Taxation. It was this committee that made an exhaustive study of taxes in general, including percentage depletion, and is expected to make its recommendations next year.

Rep. Oren Harris, also of Arkansas, is chairman of the Interstate and Foreign Commerce Committee and has been a key figure in past efforts to press through natural-gas legislation.

Rep. Frank Ikard of Texas, an authority on problems affecting oil and gas producers, will also be on hand in 1961. But there is some talk that he may seek Johnson's Senate seat.

In the Senate, any move to change the financing of the highway building program will have to pass through the hands of Virginia's Sen. Harry F. Byrd, chairman of the Senate Finance Committee.

It is reasonable speculation, therefore, that Congress in 1961 will not do things drastically different from the actions of the past 2 years.

At the same time, some members of Congress who have attacked the industry on occasion will be back on the scene, too, when Congress convenes in January.

Sen. John J. Williams, a Republican from Delaware, is continuing his term. Williams has become one of the principal leaders in efforts to whittle down percentage depletion.

Sen. Paul Douglas of Illinois, a frequent critic of the industry, also won reelection last week. Sen. Estes Kefauver of Tennessee won, too.

Rep. James Roosevelt of California, who has hammered away at the marketing practices of major oil companies, already has a critical committee report about ready for release. So his campaign seeking outright divorcement of marketing will continue.

But, ironically, the activity of these men and their committees is likely to be less important with a Democrat in the White House. Remember that, except for Williams, the men mentioned above are in the same party with Kennedy. Many of their attacks in the past have apparently been aimed primarily at embarrassing the administration.

The net effect is this: The lineup on such oil issues as percentage depletion was left virtually unchanged by last week's elections.

And since percentage depletion played only a very minor role in the campaign, even in congressional races, there was nothing in the election outcomes which should trigger a new attack.

In another election . . .

Voters Ask End to Gasoline Tax

CONGRESSMEN will get word from some 5,000,000 motorists soon that they want the 1-cent a gallon "temporary" gasoline tax to die on schedule next June.

This is the number of signatures the various state oil industry councils obtained in their petition campaigns through service stations last month.

Taxes have reached the point where, according to industry spokesmen, they are retarding demand and hence reducing revenue as well.

For every $1.50 the motorist spends for gasoline, 50 cents actually goes for state and federal taxes. The federal tax is 4 cents a gallon. With state taxes on top of this, the average for the U. S. is more than 10 cents per gallon in gasoline taxes.

Because of the soaring costs of the the interstate highway program, congressmen may be looking for more revenues, not less. The temporary 1-cent federal tax, which will die unless extended by Congress next year, is considered by the industry to be a good place to start fighting to reduce the load.

Since "temporary" taxes have a way of becoming permanent, the industry decided that the motorist ought to be heard from. The petitions calling for the 1-cent temporary tax to be discontinued will be separated by congressional district. Each congressman will be told by the state councils how many thousands of motorists in his district took the trouble to sign a petition to drop the tax.

Gas "Pool" Attracting Buyers

. . . in 13-county area of West Central Texas. The aim is to lure buyers through commitment of shut-in reserves. Interest is being shown by pipeliners and processors.

A JOINT VENTURE by West Central Texas gas producers to get new purchasers into a 13-county gas area is making headway.

So far, 43 area operators have banded together in the drive to pledge their shut-in gas reserves in a package deal to any pipeline or other gas buyer willing to sign a "fair and reasonable" purchase contract.

A producer committee disclosed that inquiries had been received from 13 pipeline firms—all but one of them new to the area—and three companies interested in gasoline plants.

The committee ramrodding the drive is the natural-gas committee of the West Central Texas Oil and Gas Association.

Its chairman, Bill Tindell, reported to the association's board of directors at the recent annual meeting that proved and uncommitted gas reserves pledged by the operators total more than 492 billion cubic feet.

These operators have 89 shut-in gas wells and 71,266 acres of proved but undrilled leases on which they would drill 209 development wells if a favorable contract could be negotiated, Tindell said.

The operators hold another 284,441 acres of leases with good gas potential in the same area. Tindell said at least 223 wildcats could be drilled on these leases.

Big lines coming . . . Two large interstate pipelines, Tindell said, "are ready to extend lines into this area as soon as the available reserves reach 750 billion cubic feet."

Transwestern Pipeline Co., Houston, acknowledged last week that it is one of the major firms ready to enter the area. And informed sources say that Natural Gas Pipeline Co. of America is the other.

A Transwestern official described his company's talks with the association as "casual" and said there is not yet enough known about the reserves in question to make any offers.

"We said generally we were interested if they had enough gas," the official said. "We are always interested in any area where there might be gas."

Transwestern's interest in the area stems from its efforts to increase the use of its new Texas-to-California line.

The company reported last week that it has completed its build-up period of deliveries to Pacific Lighting Gas Supply Co. and is now meeting its firm-contract-demand quantity of 300 million cubic feet of gas daily and maximum demand quantity of 345 million. The first gas began moving August 9.

The pipeline can be expanded to take another 300 million when it acquires a market, and the company presently has virtually enough reserves to supply such a market.

For Transwestern to hook into the West Central Texas fields, it would have to construct about 200 miles of line at a cost of some $12 million, according to one source. The company's present reserves are mainly in West Texas and the Texas Panhandle.

Natural Gas Pipeline is closer to the 13-county "pool" area than Transwestern. The southern terminus of the former's system is near Bridgeport in Wise County, just northeast of the area involved in the pledge drive.

At present, Lone Star Gas Co. is the only major gas-purchasing firm gathering gas in the area.

Tindell urged area producers who have not yet committed themselves to join the drive.

The committee will hold a meeting of producers with uncommitted gas reserves on November 17 in Abilene to discuss "acceptable" contract conditions.

Soon after this meeting, the committee plans tentatively to hold another with "several of the pipeline companies."

Tindell told the Journal he felt that area producers could easily meet the target of 750 billion cubic feet in reserves. Pipelines interested in the area, he said, have estimated that proved reserves in the area exceed 1.5 trillion cubic feet.

Tindell said West Central Texas producers feel a contract is within their grasp which would "provide a fair price, a guaranteed daily take, and equitable treatment . . . together with sufficient demand to stimulate activity in this area for many years."

The counties involved in the project include: Brown, Callahan, Coleman, Concho, Comanche, Eastland, Erath, Jones, Palo Pinto, Parker, Stephens, Taylor, and Young.

OIL MEN from all over the world keep the API's registration staff busy in Chicago's Conrad Hilton hotel.

Year's Top Oil Meeting Under Way

THE STAR gathering of the oil industry—the fortieth annual meeting of the American Petroleum Institute—begins Monday in Chicago with more than 6,000 oil men due to take part in 3 days of sessions.

Highlights will include talks by leaders in business and government, group and general sessions, and presentation of the API's Gold Medal Award for distinguished achievement.

Oil men started arriving last Wednesday for special committee meetings on almost every phase of industry operation. Committee sessions continued into Thursday.

A general session Monday will be addressed by James F. Murray, Jr., director of finance, Jersey City, N. J. His topic, pegged to last week's election, will be: "You Elected Them . . . Now Work With Them!"

M. P. Murdock, sales vice president, Ethyl Corp., New York, also will address the first general session on "Motorists Will Drive More."

E. D. Brockett, new president of Gulf Oil Corp., will be the main speaker at the annual Nomads luncheon which will be held on Monday.

At a windup general session Wednesday morning, Soviet oil competition will be discussed in a speech by Arthur H. Dean of the law firm of Sullivan & Cromwell, New York, former chief UN truce negotiator in Korea.

The same session will hear a talk by M. J. Rathbone, president of Standard Oil Co. (N. J.) and chairman of the API, who also will preside at the general sessions.

The Gold Medal Award, the industry's highest honor, will be presented to Eugene Holman, former board chairman and president of Standard Oil Co. (N. J.), at the general session Wednesday.

Major work of the convention takes place in group sessions. At these:

. . . **Production** men will hear speakers discuss U. S. demand for crude oil, the outlook for economy in oil operations, planning of a competitive organization for an independent producer, and how production research can boost profits.

. . . **Refining** men will join a forum on operating practices which will take up risk analysis and safety measures, and will hear talks on financing ideas for the future.

. . . **Marketers** will cover various reports of division committees.

. . . **Transportation** agenda includes a panel discussion on the next decade in petroleum transportation and communications.

. . . **Other sessions** will deal with research projects, government's role in a progressive economy, finance, accounting, and topics of similar interest to the industry.

Next week:

EIGHT Journal editors will attend the fortieth annual API meeting in Chicago to bring you tightly written, yet comprehensive, coverage of the industry's biggest convention.

Look for this special section of significant stories and photographs from Chicago in the November 21 issue.

API Honors Going to 23 Oil Men

TWENTY-THREE oil men will be honored with "Certificates of Appreciation" at the API's fortieth annual meeting in Chicago this week. The awards will be presented for outstanding contributions to the oil industry.

Six certificates will be awarded by the API's Division of Transportation, six by the Division of Production, three by the Division of Marketing, and one by the Division of Finance and Accounting.

One award will be made for work in fundamental research. The API committees on safety and on public affairs each will present two awards, while the committee on crude-oil measurements and the medical advisory committee each will award one certificate.

Presentation of the awards will be made at various group sessions of the 3-day meeting, which starts Monday.

Public Affairs

Harold L. Curtis
Shell Oil Co. (ret.)

Richard Rollins
Atlantic Refining Co.

Division of Transportation

R. A. Brannon
Humble Pipe Line Co.

R. H. Ewing
Cities Service Co. (ret.)

R. K. Kelly
Tidewater Oil Co.

C. E. Spahr
Standard Oil Co. (Ohio)

L. E. Reed
Mobil Oil Co.

E. E. Wickman
Shell Oil Co.

Safety

James E. Hill
Union Oil Co.

Oliver W. Johnson
Standard Oil Co. (Calif.)

Crude-Oil Measurements

George H. Suppie
Mobil Oil Co.

Fundamental Research

G. R. Lake
Union Oil Co.

Division of Production

John R. Evans
Standard Oil Co. (Ind.)

C. E. Haven
Nat'l Bureau of Standards

Edgar Kraus
Atlantic Refining Co.

Mercer H. Parks
Humble Oil & Refining

Medical Advisory Committee

John C. Ruddock
Richfield Oil Corp.

M. L. Powers
Univ. of Oklahoma

Walter F. Rogers
Gulf Oil Corp.

Finance, Accounting

Donald P. Jones
Sun Oil Co.

Division of Marketing

C. M. Blickensderfer
Sinclair Refining (ret.)

C. J. Guzzo
Gulf Oil Corp.

B. L. Ray
Esso Standard (ret.)

Find Oil—And You'll Move Up at Lion

• New plan for promotion gives rockhounds a choice. They can reach the top by going the administrative route, or—if paper work seems too irksome—they can get just as far by perfecting their professional abilities.

LION OIL CO. has come up with a plan for rewarding geologists and geophysicists who can find new oil but don't want to be administrators.

The company, a division of Monsanto Chemical Co., believes the plan is unique in the oil industry because it places the emphasis on "finding oil," rather than on experimental work in the laboratory. In other words, if an oil finder wants to better himself without going the management route, he does it by living up to his name—discovering new oil.

If he chooses to follow this course, he is freed from administrative duties and will concentrate on his professional work. In such things as salary and fringe benefits, he can earn stature equal to that of comparable administrators.

The purpose of such a plan, according to exploration director E. L. Maxwell at Houston, is to upgrade men who have the "rare talent" for finding oil without burdening them with administrative duties. It is not, Maxwell emphasized, a catchall for misfits unable to do administrative work.

"We will never tarnish this program by putting someone in it simply because he can't do anything else," Maxwell said. "We want talented geologists to be ambitious and become a part of this program."

How it works . . . Under the table of organization, geologists and geophysicists will follow one of two routes after they have gone a certain distance in the company.

All beginning geologists, for example, must first pass through the categories of geologist II, geologist, and senior geologist. Beyond the latter point they will branch off into one of two lines of progression—administrative or scientific. It is the scientific line that is new.

The three scientific categories:

. . . Resident geologist. This man is comparable to a district geologist in salary and benefits.

To get the appointment, he must have demonstrated an ability to do "high quality, original geologic work." He works under the regional geologist, rather than a district geologist, and thereby has a shorter channel of communication to the company's top brass in recommending drilling locations.

. . . Exploration geologist. This man is comparable in salary and benefits to a regional geologist or regional exploration manager.

To win the job, he must have demonstrated "scientific ability to find new oil and gas fields through original, independent geologic investigation." He has wide discretion in how he uses his time and talents.

He can work in any part of a given region (Lion has three in the U. S.), using his own oil-finding ideas on his own initiative. His immediate boss is Lion's director of domestic (or foreign) production and exploration. He thus bypasses regional channels in making recommendations for drilling.

. . . Senior exploration geologist. This is the blue-ribbon category for the man who has proved his oil-finding abilities over a period of years.

Lion would not expect to have more than one or two—if any. He would be on a par with the director of production and exploration, but there would be no upper limit on his salary. He would be free to roam the world in seeking new oil, and he would be his own boss on the use of his time.

Who's affected . . . Lion has about 60 professional geologists and geophysicists in its domestic operations and perhaps 10 more in foreign work.

All would be eligible to advance under one of the two routes—administrative or scientific.

Maxwell said there will be no specified limit on the number of men who will eventually get titles in the scientific category. Perhaps 15 or 20 would advance into these ranks over the next decade.

Most oil finders, he believes, will prefer to climb the administrative ladder because it offers a wider variety of work. But he pointed out that ad-

DIAGRAM SHOWS the common beginning for geologists at Lion Oil and how they may advance through parallel lines of progression.

ministrative jobs are limited while those in the scientific line of progression are not. The scientist does not have to wait for someone to die, resign, or be promoted in order to advance. All he must do is prove he can find new oil.

The first appointments in the new advancement plan will be announced within the next 60 days, Lion President H. H. Bible said last week.

Advantages . . . Lion is not embarking on an uncharted sea entirely.

Other oil companies have somewhat similar plans, but in most cases the emphasis is on theoretical laboratory work.

The Lion plan provides a shortcut to top management for gifted oil finders who want to spend full time at their professional job. Their recommendations on where to drill will very likely be followed.

Furthermore, once a drilling site has been established, the scientific geologist can move on to other areas and let the administrative line do the follow-up work.

The plan also calls for giving a specialist in one of two top scientist categories a staff of his own to do the detail work that would otherwise waste his time. He would not be required to do administrative work with this staff. Others would handle his budget, make reports, and perform allied duties.

The company . . . Lion Oil operates in all oil areas of the U. S. except the Far West and has about 29,000 to 31,000 bbl. daily of net production.

Headquartered in El Dorado, Ark., since its founding in the early 1920's, it was merged into Monsanto 5 years ago and has operated as a division since that time. The headquarters will be moved to St. Louis next spring. Production and exploration department headquarters will remain in Houston.

The idea for the advancement of key scientific personnel who are not administrators was pioneered by the parent company, Monsanto, 10 years ago, but it had never been applied to geologists and geophysicists until now.

California Gas Wells Pay Out Quickly

• Report cites top wellhead price, absence of regulations as incentives for drilling in Sacramento Valley. Two-year payout is claimed for average well.

THE GAS PLAY in the Sacramento Valley of California has all the ingredients of a money-making proposition: Good geology, a ready market, a high wellhead price, and a political climate free from any type of regulation.

Gene Reid, of Occidental Petroleum Corp., one of the more active companies in the play, says the average gas well in the Arbuckle area of the valley will pay out in 2 years. He figures the time on a pay thickness of only 20 ft. If the pay sand hits 60 ft., the payout drops to 8 or 9 months.

This glowing report of the exploration prospects in Sacramento Valley was given at the annual meeting of the Pacific section of the American Association of Petroleum Geologists. The Los Angeles meeting was held jointly with the Society of Exploration Geophysicists and the Society of Economic Paleontologists and Mineralogists.

The gas play was one of the two hot exploration areas in California which shared much of the attention at the meeting. However, the other area—offshore California—fell far short of getting such a bright report. Offshore play is hampered by lease restrictions which run up exploration costs and make some areas uneconomical.

Gas payout . . . Gas produced in the Sacramento Valley commands a wellhead price of 30 cents per M.c.f., well above what is paid in most of the U. S. and Canada.

Reid outlined the fast payout for the Sacramento wells by using average costs for the wells Occidental has drilled in the Arbuckle field.

He said total cost of drilling and completing an F-zone well to about 6,500 ft. is approximately $110,000. An F-zone well with a 20-ft. pay section should give the operator an "undiscounted net income" of $779,000 over a 20-year period, he said. This is based on recovering 75% of the gas and a total recovery of 3,700,000 M.c.f. Also figured in is a 1/6 royalty.

Operating costs are figured at $150 a month or $36,000 for 20 years, Reid said. With these factors, the 20-ft. pay section would give the producer gas equal to a gross value of $1,110,000—and if the well turns up with a 60-ft. pay sand, the gross would jump to $2,400,000.

The market . . . Sacramento gas has a big advantage in its proximity to the market.

The valley is only 150 miles from San Francisco, where Pacific Gas & Electric Co. plans to import gas 1,400 miles from Canada. Reid said two-thirds of PG&E's cost of gas laid down at San Francisco is the cost of moving the gas from Canada.

"Imported gas cannot compete with our domestic gas," he added.

Another advantage for the Sacramento gas producer is a minimum take-or-pay clause in PG&E contracts, assuring producers of a steady income.

Added to these advantages is the fact that selling gas to PG&E is an intrastate deal which does not involve any regulation from the Federal Power Commission. And California has no market-demand proration laws which limit producers to any given amount of production.

Offshore play . . . Frank J. Hortig, executive director of California's State Lands Commission, said lease requirements facing the company exploring in the state's tidelands are the "most complex" of any in the world.

Hortig said these lease restrictions result in development costs which make exploring off California unattractive to many operators. However, technical developments in offshore drilling and production methods hold promise of trimming some of these costs.

He cited the ocean-floor completion technique developed by Richfield Oil Corp. and used by a Peruvian affiliate of Richfield's as one method which may be adapted to completing wells off California.

Underwater completions could help the explorer off California in two ways: They would allow development in the deeper waters where platforms and barges can't operate, and they would permit completions in shallow waters where sands may not be thick enough to justify building a platform or artificial island.

Hortig purposely sidestepped any reference to the best place to look for oil off California. His office has recommended that four blocks off Santa Barbara County be leased, but he said nothing at the meeting to indictate which is the most attractive block—or if any is worth leasing.

Cities Service to Streamline Operations

- Freedom from SEC supervision will bring consolidation of activities, soon to be followed, probably, by acquisitions and mergers to strengthen its crude position and give the company better balance.

EMANCIPATION from the strictures of the Public Utility Holding Company Act of 1935 will be the signal for Cities Service Co. to begin a long-awaited corporate consolidation next month.

Cities Service will become owner of all the outstanding stock of Arkansas Fuel Oil Corp. on December 3, thus removing the last reason for jurisdiction of the act. Then Cities Service will no longer be required to check every corporate move with the Securities and Exchange Commission.

This will mean that Cities Service is finally in a position to streamline operations where it sees fit and to act quickly in the case of mergers and acquisitions.

Cities Service will pay about $75 million for the 1,843,346 shares of Arkansas Fuel.

The first step under its new freedom will be the consolidation of domestic oil exploration, production, and related activities, with headquarters in Bartlesville, Okla. Burl S. Watson, chairman of the parent Cities Service Co., New York, announced the consolidation will be undertaken shortly after the Arkansas Fuel stock purchase is completed.

Robert L. Kidd, now president of Cities Cervice Oil Co. (Del.), the principal operating subsidiary, will become chairman. He will continue as chief executive officer. J. E. Heston, president of Arkansas Fuel since 1956, will retain that position and also will become president of Cities Service Oil Co. (Del.).

The next step will be to tighten the various marketing operations. The company announcement didn't mention a consolidation of affiliates in marketing, but rather referred to studies pointed toward "improvements and efficiencies which appeared impracticable until Arkansas Fuel became a wholly owned Cities Service subsidiary."

Holding-company problems . . . The use of the word "impracticable" referred to the trials Cities Service would undergo by attempting any move while still under the Public Utility Holding Company Act.

This act has had a profound effect on the company. It has sharply altered its character, and has been a handicap in its efforts to shift with changing times as other companies have to meet new competitive conditions, especially in the past 2 or 3 years.

Robert L. Kidd
. . . moves up to chairman's post

J. E. Heston
. . . will take Kidd's present job

Between 1910, when Henry L. Doherty founded Cities Service as a utility company, and 1939, the year of his death, 250 utility corporations were acquired, created or merged by the company. Hence the 1935 law confronted Cities Service with what it called an agonizing dilemma.

If it stayed in the utilities business, it would have to dispose of its oil and gas interests and confine itself to a single integrated utility operation in a limited area. If it stayed in the oil and gas business, it would have to dispose of all of its utilities interests.

Cities Service, of course, chose petroleum, and between 1943 and 1954 it sold the utilities for more than $185 million, realizing a profit exceeding $100 million.

In September 1957, the SEC directed Cities Service to buy the public minority stock interest (48.5%) in Arkansas Fuel, or dispose of its own majority interest. After protracted negotiations and proceedings before the commission, a formula agreeable to all was found.

Cities Service is buying the minority interest for $41 a share cash, using a production-payment method of financing with its resulting tax benefits.

With the minority interest eliminated, Cities Service no longer will be subject to provisions of the holding company act.

Cities Service has hardly stood still between 1941, when it registered under the act, and the present. Oil and gas revenues increased from $180 million to $788 million, and assets increased to $1.25 billion.

But being subject to the act has been a deterrent to any organizational changes or acquisitions to strengthen the company. Such moves weren't impossible. But the 3-year travail before the SEC over the Arkansas Fuel minority interest provided an object lesson in what could happen.

Cities Service organization . . . The rather loose Cities Service family of oil and gas enterprises is not considered the best possible operating setup for coping with the challenging industry conditions of the 1960's.

Cities Service operates through several subsidiaries, most of them wholly owned:

Cities Service Oil Co. (Del.), the main operating subsidiary at Bartlesville, engages in all phases of the oil business and is a natural-gas producer. It owns refineries at East Chicago, Ind., and Ponca City, Okla., and markets products in 14 midwestern states.

Arkansas Fuel Oil Corp. engages in

all phases of the oil business except refining. It markets in 11 southern and southeastern states.

Cities Service Oil Co. (Pa.) markets in 13 New England and Mid-Atlantic states. It owns a fleet of ocean tankers supplying eastern seaboard terminals, and an asphalt refinery at Linden, N. J.

Cities Service Production Co. produces crude oil and natural gas, mainly in Oklahoma, Texas, Louisiana, and in the Gulf of Mexico.

Cities Service Refining Corp. owns a refinery at Lake Charles, La., which supplies marketing affiliates with products in the eastern and southern states.

Cit-Con Oil Corp. (65% owned) has a lube-oil plant at Lake Charles.

Cities Service Gas Co. produces, buys, transports, and sells natural gas mainly to gas-distribution companies and industries in Oklahoma, Kansas, Texas, Missouri, and Nebraska.

Cities Service Research & Development Co. conducts research in three principal laboratory centers.

What next? . . . The exploration and production consolidation at Bartlesville could put Cities Service in a position to acquire reserves to strengthen its crude-supply position.

The company last year produced 124,745 bbl. daily of crude and other petroleum liquids. Refining capacity is 313,000 bbl. daily.

Cities Service is known to be considering various merger and acquisition propositions. Many producers are finding it more profitable to sell oil in the ground than to produce it. And major companies find it advantageous to add to reserves by buying oil in the ground and financing the purchase through production payments.

This type of deal fits Cities Service's picture now.

When marketing affiliates have been realigned, the company will be in a much better position to coordinate sales strategy. And it will also be in a position to strengthen weak spots by acquisitions. Cities Service does not have the disadvantage of a variety of brand names, as some major companies have had, and hence this is not a ruling factor in consolidation.

Cities Service now markets in 38 states east of the Rockies.

No big rush . . . In Bartlesville, Okla., Robert L. Kidd said the consolidation of exploration and production operations will be spread over an "extended period of time."

This, he said, would minimize the impact on both the employes and the communities involved. Ultimately, he said, "a number of families" will be moved from Shreveport to Bartlesville

watching WASHINGTON

Clyde La Motte

• FPC may reshuffle gas-price area boundaries . . .

BEFORE it goes much further with the area-pricing approach to natural-gas regulation, the Federal Power Commission is likely to redefine area boundaries.

Such new area lines would follow the natural boundaries of gas fields and would group fields of a similar nature rather than following state borders or other political subdivision designations.

As it is now, the pricing areas have boundaries which have no relation to gas production. For example, there are 11 areas in Texas, corresponding to the 11 Texas Railroad Commission districts. Outside Texas, there are 12 other price areas which generally follow state lines.

Under a new alignment, there may be only three or four areas designated in Texas, and some of the Texas fields might be grouped with some fields in Louisiana, Oklahoma, or New Mexico to form a pricing area.

In the opinion of some top officials at the FPC, such a move is necessary to make the area-pricing approach feasible. Frankly, they doubt their ability to defend the legality of a price for one of the present areas differing from that of an adjoining area simply because a state or district line happens to separate the two.

Under the new realignment, however, area-price differences could be justified by differences in drilling depths, types of formations, proximity of markets, and other factors.

• Public hearings on area designations likely . . .

LOOK FOR the move to set up the new pricing areas soon, possibly within 2 weeks.

The FPC is aware that there is little point in applying current area prices or holding hearings on the price ceilings of a given area if new area designations are to be made. So a decision on realignment is the first order of business.

The FPC may make the new area designations on its own, or it may call a series of hearings to help it determine proper area boundaries. The latter procedure is more likely.

• Would legislation provide solutions sooner? . . .

IF YOU do not understand clearly just what the future procedures of the FPC will be under the area-pricing approach, don't worry. No one else knows either, not even at the commission.

The commissioners issued the September policy statement fully aware that it left many questions unanswered.

Their intentions were—and are—to issue clarifying statements as soon as possible. They are busily working to that end now.

Aside from redefining area boundaries, there are several key steps the FPC must take before any real progress can be made in setting specific standards and in disposing of the backlog of cases.

First, the members of the commission will have to reach agreement on a number of points on which they still have widely varying views.

Also, the commission obviously needs to let the industry know what type of evidence it wants in considering area-price changes.

And it must give the commission staff more guidelines for use in handling the filings already on hand.

Finally, there is an almost endless array of smaller problems that will have to be met, such as a determination of how a pipeline company's own production is to be evaluated for rate purposes.

Those in the industry who feel that this confusion proves the need for corrective legislation should bear in mind that such legislation would do no good unless it provided the answers to the very problems the commission has been wrestling with.

Therein lies the rub.

Biggest LPG Cavern Finished

• Sun Oil Co. serves lunch in the "mole room" as it formally opens its 400,000-bbl. mined-granite cavern at its Marcus Hook refinery.

SUN OIL CO. last week formally completed the world's biggest mined LPG storage cavern.

With a capacity of 400,000 bbl., or 16,800,000 gal. of liquefied propane, it is the largest cavern ever hewn from a single shaft.

The massive new cavern is the last of three carved from solid granite at Sun's Marcus Hook refinery. It increases the over-all capacity of the Marcus Hook underground system to 37,800,000 gal. of LPG.

Floor of the new cavity covers 53,428 sq. ft., all within an area of less than a quarter acre. Ponderous granite pillars left as supports divide the area into many interconnected sections. Because of the 42-ft. height of the cavern, it has a total storage volume of 2,244,000 cu. ft.

The cavern was dedicated at a luncheon ceremony 420 ft. below ground attended by officials of Sun Oil, Fenix & Scisson, Inc., mining engineers and general contractors on the excavation, pipeline transmission companies, and gas utility firms. Guests descended into the cavern, nicknamed the "Mole Room," four at a time via the 42-in.-diameter shaft.

The company said the over-all cost of the three caverns was $5 to $7 per barrel of storage, compared with as much as $50 per barrel for above-ground storage.

Sun is now starting to pump LPG into the cavity, a job expected to take 6 months.

Fenix & Scisson used a combination of oil-well drilling and hard-rock mining procedures to excavate the Marcus Hook caverns. In the final cavern, big tractors and rock loaders were sent down the 42-in. shaft piece by piece and reassembled at the bottom.

The process was repeated in reverse when the excavation was completed. More than 200,000 lb. of dynamite were used in this phase of the project.

Excavation took about 13 months, with 285,710 buckets of broken granite hoisted through the shaft. The contractor used two 35-man shifts per day during the operation.

Total cost, including above-ground facilities, is considerably less than $3 million. Comparable above-ground storage would take 600 tanks at 700 bbl. per tank covering 25 acres. Cost would be more than $16 million, excluding the price of land.

Floors have been cemented to lessen future pump damage to rods and bearings caused by small floating particles of granite. There is no maintenance on the cavern itself, and insurance rates are about half those for above-ground storage.

The new cavern is the nation's thirty-third mined storage area for LPG. It is the first blasted in granite for the sole use of liquefied propane.

Tuscarora Sold

... to Buckeye by Esso. Old line dates back to 1908.

THE INDUSTRY'S first refined-products pipeline, the 300-mile Tuscarora Pipe Line Co. system stretching across Pennsylvania, is being sold to Buckeye Pipeline Co.

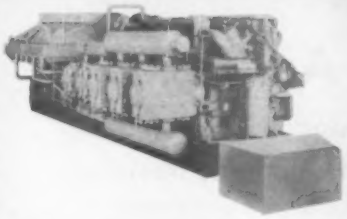
Tuscarora is a 10 and 12-in. system pumping products from a connection with Buckeye at Allentown, Pa., westward to Midland, Pa., 33 miles down the Ohio River from Pittsburgh. Tuscarora has terminals at Reading, Harrisburg, Johnstown, Altoona, Pittsburgh, and Midland.

The firm is owned by the Esso Standard Division of Humble Oil & Refining Co. The name is not being sold. Most of the field personnel will continue to operate the line.

Tuscarora was built in 1908 to move crude oil from western Pennsylvania to the Esso refinery at Linden, N. J. The original 6 and 8-in. system was converted to products in 1929, ushering in the era of products pipelining, with the flow being reversed to pump westward.

Tuscarora was rebuilt in 1953 as a modern pipeline, and the Allentown-Linden section was retired. The year before, Buckeye built its 16-in. line from Linden to Allentown, where it tenders product to Tuscarora and to its own system extending north from that point.

Buckeye is an independent common-carrier crude and products system operating in the Midwest, East, and in Florida through its interests in Everglades Pipe Line Co.



Design engineered for gas booster service in the Louisiana Gulf Coast area, this packaged GMXF-10 compressor moves 4.43 MMSCFD. It is rated at 825 bhp. Equipped with Entronic Controls for remote field operation, this unit is a typical example of the efficiency gained by specifying C-B/Southern Packaged Compressor Plants.

CB/S

PACKAGED COMPRESSORS

Designed Engineering For . . .

CB/S Packaged Compressors Starts With the Customer's Problem

Sound gas compression engineering starts with understanding the basic problem. C-B/Southern sales engineers are registered petroleum engineers with actual producing experience. They assess the customer's problem, whether it is gas gathering, gas lift or gas injection, to make positive, workable suggestions. From quotation to field installation, engineering knowledge is based on practical experience. For example, last year, C-B/S built more horsepower than any other two compressor packagers combined. And because the company offers the widest range of horsepower size, C-B/S engineers have the right component to meet every specification the customer wants.

As an added benefit, C-B/Southern Packaged Compressor Plants are never orphans. Backed up by engineers in 22 Cooper-Bessemer sales and service offices, C-B/Southern service operates on a 24-hour schedule, everywhere.

C-B/S Packaged Compressor Plants are available in horsepower ratings from 100 to 1100; unitized compressors, both reciprocating and centrifugal, to 10,500 horsepower.

CB/S

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Area Pricing to Bring Problems

• It may not stand up in court, IPAA head tells West Central Texas producers, and even if it does, efforts to puncture price ceilings will create confusion.

AREA PRICING of natural gas by the Federal Power Commission may create more problems than it will solve.

That's the belief of Alvin C. Hope, president of the Independent Petroleum Association of America, who thinks gas producers should intensify, rather than relax, their efforts to free themselves from federal control.

Hope, also a producer member of the "gas task force" of producer, longline, and distributor representatives, spoke at the twenty-seventh annual meeting of the West Central Texas Oil and Gas Association.

Admittedly, he said, FPC is taking a step in the right direction in acting to lessen its workload. And the agency should be praised for its realism concerning the impossibility of regulating a gas producer as a utility.

"But I fail to see how the area-pricing concept will produce the gas to meet anticipated huge consumer needs," he said.

Administration of the area-pricing concept may not be "as vicious as the present chaos of rate cases," Hope said. "But I can see a state of confusion setting in when the petitions to pierce the area price ceilings begin to mount up."

Furthermore, he added, "It is doubtful that area pricing could withstand a court test successfully."

Task force bogged down . . . Hope indicated that the "gas task force"—composed of three members of the producing, transmission, and distributing segments of the industry—is still working industriously but has tended to bog down on the price issue.

He indicated that producer members are standing firm in their push for gas classification as a commodity and for arms-length bargaining.

For this, he said, they would be willing to agree "that certain types of contracts should be forbidden and certain standards set up—much as in the Harris-Fulbright bill."

Hope said he had found, among distributors especially, a growing understanding of the problems confronting producers under federal regulation. "But there still is a tendency on their part to hold back on the very items we think so essential."

"One can understand their fears of being priced out of this commodity market by runaway prices. But, on the other hand, if producers continue to be priced out of the market in interstate sales, the end result is the same to the distributors.

"If they cannot get the product because of its scarcity, the distributors are out of business on that portion of their demand which cannot be met regardless of what the price might become."

Hope said he felt one of the biggest reasons for distributor resistance to higher gas prices is that they are inclined to look at averages of all present long-term contracts.

This is fallacious, he said. The distributors fail to realize that the averages are pulled down to unrealistic levels by contracts entered into long ago on a "distress" basis. In earlier years, he said, producers signed contracts to sell gas at a price adequate perhaps only "to pay for the pipe and something besides." "They had a choice either of doing this or plugging the well."

Now these old prices, Hope said, tend to hold down any general price average to a level at which a producer cannot now sell at a profit.

Alvin C. Hope
. . . Not vicious control, but confusion.

Klondike Oil Road Advances

• Trucks will haul supplies to Chapman Lake when the job is completed. Builders hope to be ready by freeze-up.

OIL-HUNTING engineers are pushing a development road from the Alaska Highway into the heart of the Klondike, over a rugged route blazed by gold prospectors of 1898.

The road begins at Flat Creek, 25 miles southeast of Dawson City. It runs northeast for 50 miles into the Ogilvie Mountains, a barrier between the Klondike country and the tundra extending to the Arctic coast.

Work is being hurried on a 22-mile stretch of winter truck route which will bring the road to Chapman Lake, a relay base for airborne oil explorations for the past 5 years.

From Chapman Lake the oil men will haul supplies to their drill sites by tractor train.

At 30 miles out, the road and the Klondike River run side by side through a narrow valley where the 6,000-ft. mountain peaks seem to be directly overhead.

At mile 44 the road begins a rapid ascent of the mountains, reaching an elevation of 4,200 ft. at mile 50.

Most of the road has a dry gravel surface.

Stretches of muskeg, over which one-quarter of the road was built, were surfaced by the slash-and-leave method. The heavy growth was cut and left to form a base without disturbing the insulating moss over the permafrost. Gravel was then piled on top of the timber.

Beyond mile 50 road crews are working with bulldozers and rippers, tearing up soggy moss and shoving black gravel and natural binding from the river bed.

If they can finish their job by freeze-up, supply trucks will climb the Ogilvie Mountains and crawl down into Blackstone Valley on the other side this winter, carrying supplies to Chapman Lake.

Politics Called Storm-Threat to Exploration

• Geophysicists told of perils ahead because of Soviet ambitions, the spread of nationalism, and a chance that some governments may be less willing to dicker on concessions. Prediction: The outlook will brighten eventually.

OIL EXPLORATION in the Free World may be caught in widespread political squeezes during the coming year.

That warning was sounded by Dr. George C. McGhee, Dallas, in a speech at the thirtieth annual International Meeting of the Society of Exploration Geophysicists in Galveston last week.

McGhee spelled out some of the factors in the political picture as:

... **the Russian drive** for world domination. He said direct competition with the Soviets and the resulting impact on exploration activities will have strong influences on the international oil industry.

... **the upsurge** of nationalism. In McGhee's view, more countries in the Middle East, in southern Asia, and in Africa are going to climb aboard the nationalist bandwagon and a distrust of foreigners may affect oil companies' bids for exploration concessions.

... **a trend** toward government control. Such a trend in many countries is not necessarily related to nationalism, McGhee said.

... **the neutralist** attitude. The Dallas geophysicist and oil operator said some countries choose to keep aloof from both Russian and American influences, a stand which can postpone the development of their natural resources.

... **emancipation** of smaller nations. Independence often gives a small country a feeling that it can handle its affairs without the need for help by foreign companies, and in such cases there is less incentive for exploration.

Despite the threat of adverse political climates, McGhee found reason to hope that the outlook has some bright areas. He pointed out that political situations change, and the change can be for the better.

Summarizing, McGhee said the short-range forecast is gloomy but in the long run there are good prospects for a world-wide increase in exploration.

Tempo of exploration ... The speaker reminded his audience that a number of factors insure the continuation of exploration activities at a reasonably healthy rate. This holds true in spite of economic slumps like the one which curtailed operations in many areas last year, he said.

Dr. George C. McGhee
... urges American technologists to keep ahead of the Russians.

Among balancing factors, McGhee listed these:

... **big investments** have been made by international oil firms in facilities for refining, marketing, and transportation. The owners will protect their investments even after they have reached the limit of their economic value.

... **companies lacking reserves** abroad will seek such reserves to avoid being dependent on other firms.

... **pricing of world oil** still yields high returns and some companies would be willing to accept lower returns.

... **tax advantages** allow some firms to use surplus funds advantageously in oil exploration.

... **foreign exchange shortages** cause several countries to encourage exploration concessions.

... **some companies** have refineries in nations that have no production now but are prospective producing areas.

... **the hope** of hitting a bonanza that will be profitable regardless of world economic conditions is always alive.

McGhee urged American technologists to keep ahead of the Russians. He said exploration people should be aggressive and flexible in their dealings with foreign nations—patterning the approach to the problem at hand.

Ultimately, he said, there is a good chance of a more widely diffused demand for oil and the increasing needs within certain countries will have a direct bearing on price structure.

Arctic Wells Soon

... to be drilled, predicts Canadian resources body.

CANADIAN officials predict oil drilling in the Arctic within 2 years if current studies bear out hints of major pools beneath the permafrost.

Data gathered in the second season of oil exploration in the Arctic islands now is being sifted by government experts.

"We're very optimistic," a scientist in the Department of Northern Affairs and Natural Resources said.

Even if a strike is made, observers in Ottawa see little chance of Arctic oil's competing with Alberta crude. It will be cheaper to move oil to Canadian and American markets from Alberta than from the Far North.

Arctic oil could be sure of a market, however—Japan and Britain are relatively short tanker runs from the Arctic and both are without domestic oil reserves. Industrial markets in these areas would be thirsty for the oil.

A department official said any Arctic reserves would have to be very large—something like a billion barrels—to allow economic production.

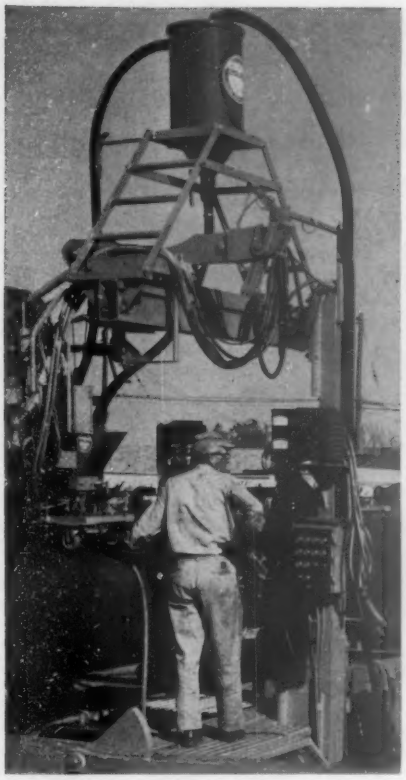
Tight Hole Is Going Deep

AN IMPORTANT offshore Texas well which had been projected to 10,000 ft. was drilling last week below 16,000 ft.

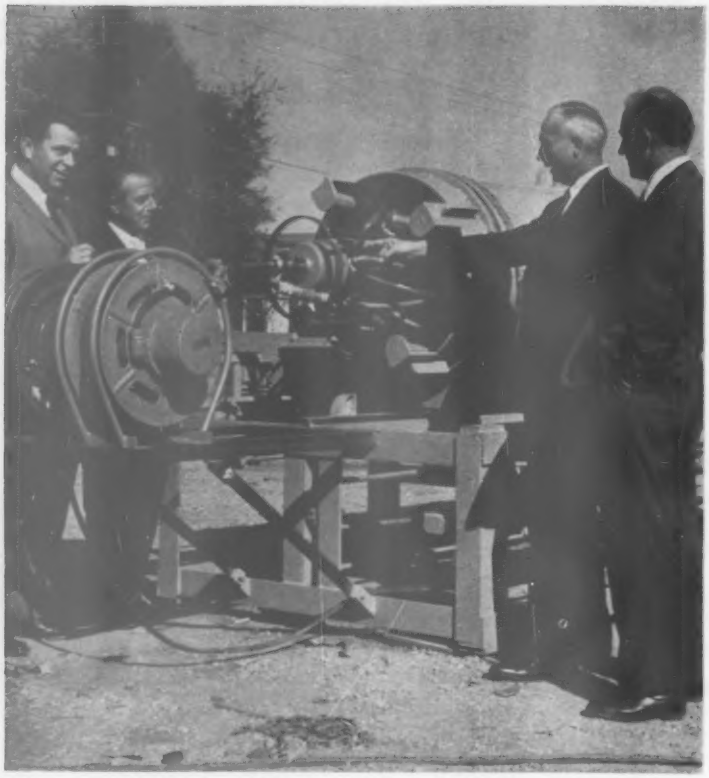
Shell Oil Co. was giving no hint as to what it was finding in the double-tight hole, the first test of a $6 million tract 31 miles south of Galveston (OGJ, Aug. 29, p. 58).

Since spudding more than 2 months ago, the company has changed the projected depth from 10,000 to 12,500 to 15,000 ft., and was down to 16,091 ft. last week and still drilling.

Zapata Off-Shore Co.'s mobile rig Vinegarroon is doing the drilling in 65 ft. of water in Federal Block OCS-288.



ONE OF the double-jointing machines that will be used for the pipeline.



EQUIPMENT MEN and contractors* look over a line-up clamp on a double-jointing machine built by Crose-Perrault Equipment Corp.

New Technique Specified for Big Gas Line

• Double jointing with submerged-arc welding is required for first time on a major line. Entire system of 30 and 36-in. pipe will be laid with 80-ft. joints.

ALL 1,250 miles of the 30 and 36-in. main line of the Alberta-California natural-gas pipeline will be double jointed by mechanized submerged arc welding units.

It is the largest job in size and length ever to be done in this manner.

Double jointing was specified by the principal sponsor of the line, Pacific Gas & Electric Co., and by the managing engineers, Bechtel Corp. in the U. S. and Canadian Bechtel, Ltd., in Canada. It was the first time that such a specification was made by a company on a major project and, as such, is a radical departure from customary practice.

The major advantage resulting from this type of double jointing is the superior weld made by the submerged arc process.

Double jointing consists simply of joining two 40-ft. joints into a single 80-ft. joint. Half of the welding is thus completed before the pipe is moved to the right-of-way.

Three different types of units will be used. One is the Crose Price-o-matic. One of these is now en route to Rocky Mountain House, Alberta, where it will double joint pipe for the northern sections of the line to be built by Dutton-Williams and Majestic Contractors. A unit of similar design is now operating at Burney, Calif., on the California portion being built by H. C. Price.

A unit developed by Bechtel, using a "dog-leg compensator," will do the double jointing in Alberta for Mannix-Piggott operations.

Two units of another type, developed by Stanley-Bledsoe Corp., are operating at Sprague River and Madras, Ore. They are double jointing pipe for the Oregon and Washington sections to be built by J. P. Neill & Co. and Western Pipe Line, Inc.

In addition to the double jointing, yard coating is also being done at plant sites in the United States. All the California pipe will be Somastic coated, while the Oregon-California-British Columbia portion will be protected with asphalt coating, glass mat, and asbestos felt. In Alberta, the coating will be done with line-traveling machines. They will apply a glass inner-wrap in the coating and a glass outer-wrap.

The U. S. and British Columbia sections of the line will be 36-in. pipe weighing 3.2 tons per 40-ft. joint. This pipe has a well thickness of 0.438-in. In Alberta, where lower operating pressures will permit use of thinner wall pipe, the 36-in. pipe will have a wall thickness of 0.406 in. The 30-in. pipe will have 0.359-in. wall.

Only 5 miles of pipe have been laid so far. This is in southern Alberta, where work has been suspended

*E. M. Hubach, left, general superintendent of Williams Brothers Corp.; John W. Brand, vice president and general manager of Crose-Perrault Equipment Corp.; B. E. Barnes, vice president of Williams Brothers; and Clare G. Miller, president of Crose-Perrault.

because of adverse weather. All contractors are proceeding with clearing and grading of right-of-way.

The entire system, including proposed laterals, will be nearly 1,600 miles long. The main line will total 1,252 miles. Pacific Gas & Electric will have 296 miles in California; Pacific Gas Transmission Co., 614 miles in Oregon and Washington; Alberta Natural Gas Co., 107 miles in British Columbia; and Alberta Gas Trunk Line Co., 235 miles in Alberta.

Soviets End U. S. Oil Tour

A BUG-EYED group of Russian oil technologists capped a month's tour of the U. S. industry with a weekend of sightseeing in New York before flying back to Moscow on Sunday.

The nine-man group, which arrived in New York October 13, expressed gratitude for American hospitality extended during the tour arranged under the auspices of the State Department and the American Petroleum Institute. The tour reciprocated the month-long trip through Russia by a group of American oil men in August (OGJ, Sept. 12, p. 72).

The Russians, although loath to concede anything to the American industry, found modern plants and field equipment which could hardly fail to arouse envy in a Soviet engineer.

Studded with top engineers and research men, the Russian delegation concentrated on new equipment and operating techniques which they can put to work at home.

Tidewater Stops Dividends

. . . on its stock. Directors also okay a stock-swap plan that some view as a new step toward merger with Skelly.

DIRECTORS of Tidewater Oil Co. have declared a moratorium on dividend payments.

The company began paying stock dividends in 1954. That was the only year in which cash dividends were paid, and Tidewater has announced no further cash dividends will be paid for at least 5 years.

No date for resuming the stock dividends was mentioned, but it is doubtful the company will resume such payments. A company spokesman said one reason for stopping the stock payments was the belief that enough stock had been issued. There were 14,507,027 common shares outstanding as of September 30.

The directors have approved a recapitalization plan which will let common stockholders trade their stock to the company for $1.20 cumulative preferred stock on a share-for-share basis. This offer is open to all common stockholders other than Mission Development Co., Mission Corp., and Getty Oil Co., the three J. Paul Getty interests which own control of Tidewater.

The share-for-share trade is limited to 3,804,292 shares, believed to be the number of outstanding common shares not owned by Getty.

Recapitalization is subject to consent of the three Getty companies on or before November 30, but announcement of the plan is considered tantamount to consent.

The stock-swap plan would have no bearing on effective control of Tidewater since the company has long been controlled by the Getty interests. However, converting the common to preferred would give Getty a larger equity in Tidewater because the evaluation would remain the same while the number of common shares would decrease.

There was speculation that the move by Tidewater directors is another step in the long-discussed merger of Tidewater with Skelly Oil Co. The merger was called off last year after being studied actively by the two companies for 5 months (OGJ, Sept. 21, 1959, p. 115).

Deep Test Cores Off Florida

THE California Co.'s deep test in offshore Florida was coring at 12,326 ft. last week. The tight hole has a projected depth of 13,500 ft.

Calco's offshore rig S-45 is drilling off Lee County about 66 miles northeast of Florida's Sunniland field, the only producing area in the state.

The well is located on a coastal Caribbean Co. lease.

PIPELINE BRIEFS . . .

There is still a possibility that Tennessee Gas Transmission will be able to import Canadian gas at Niagara Falls, N. Y. The FPC, which denied Tennessee's application in September, has agreed to reopen hearings December 19. Tennessee wants to take up to 204 million cubic feet daily from Trans-Canada on an availability basis through an existing interconnection near Niagara Falls.

A new sales record of 543 million cubic feet of gas daily has been set by Trans-Canada Pipe Lines Ltd. Peak-day requirements a year ago were 286 million cubic feet. For the past 12 months, sales have averaged 70% above the preceding year. Factors in the increase are Canada's growing demand for gas and the start of exports to Midwestern Gas Transmission Co. at Emerson, Man.

The FPC has stamped a tentative okay on the application of Tennessee Gas Transmission Co. for construction of 50.5 miles of 10 to 16-in. gathering lines to serve Delta Block 30, South Timbalier Block 54, Bay Marchand Block 30 and Callioi Island fields in Louisiana's offshore area. Cost will be $4,591,000 and 341.4 billion cubic feet will be added to available reserves.

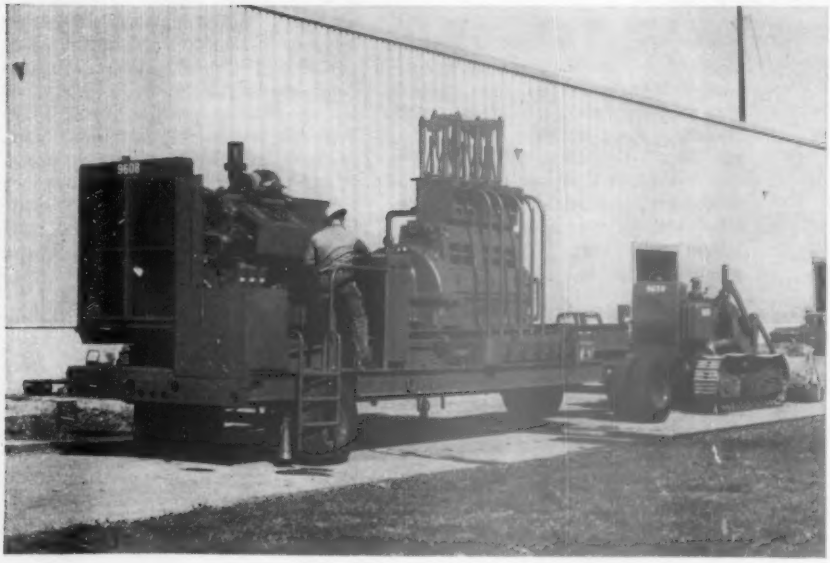
Revenues of the Little Big Inch system of Texas Eastern Transmission Co. were 36.5% higher in first three quarters of 1960 than in the same period of 1959. The system will soon be connected to the Buckeye Pipeline by an 89-mile pipeline from Texas Eastern's terminal at Lebanon, Ohio, to Buckeye's Lima, Ohio, terminal. It will enable the Little Big Inch system to deliver to Columbus, Cleveland, Lima and Toledo, Ohio, and Detroit, Flint and Owosso, Mich., through the Buckeye system.

Also for Pipeliners . . .

IN THE NEWS: Prospective buyers among pipeline companies and processors are showing interest in a plan for pledging gas reserves in a 13-county area of West Central Texas (p. 104) . . . One of the nation's oldest pipelines, the Tuscarora in Pennsylvania, is being sold by Esso (p. 112) . . . The Canadian Government is reported to be giving serious consideration to the long-pending idea of an Alberta-Montreal pipeline (p. 121) . . . A company led by Texas Eastern Transmission offers to build and operate a gas transmission system in Argentina (p. 125).

Storage Site

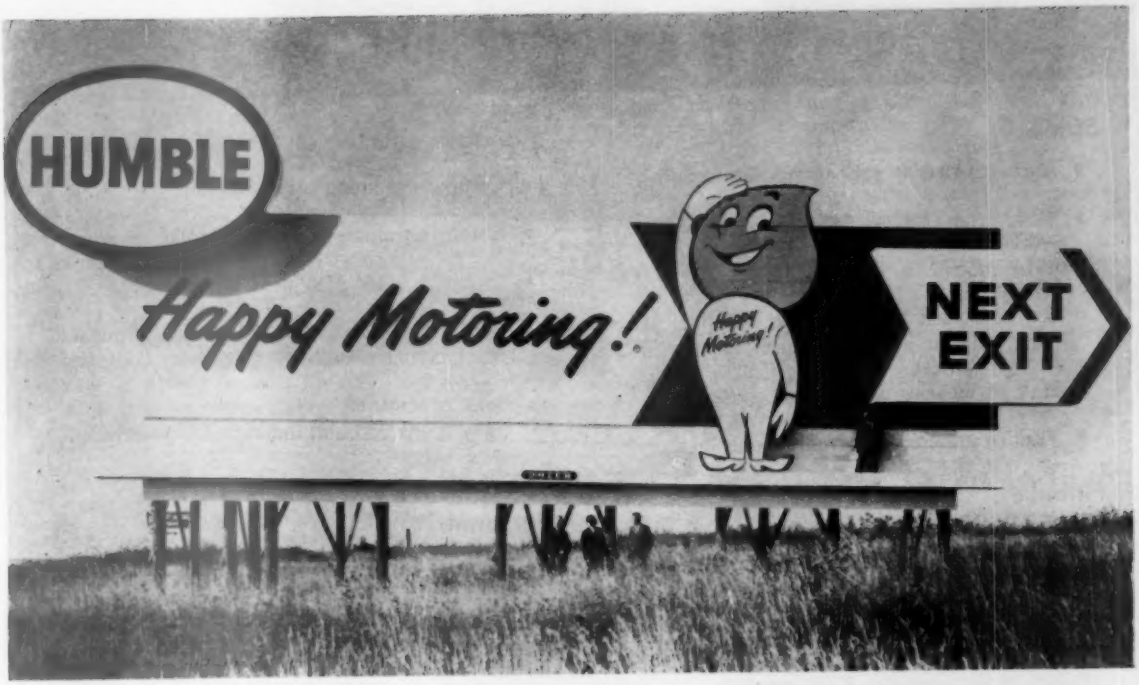
THE SWATH cut through the dense cypress in the background shows the site of Esso Standard's sixth storage well at Sorrento, La., salt dome. The new well will be used to store propane and will have a capacity of 350,000 bbl. It is scheduled for completion in July. Total capacity at Sorrento will be 1,820,000 bbl. The christmas tree is on an existing well.



Real Washpower

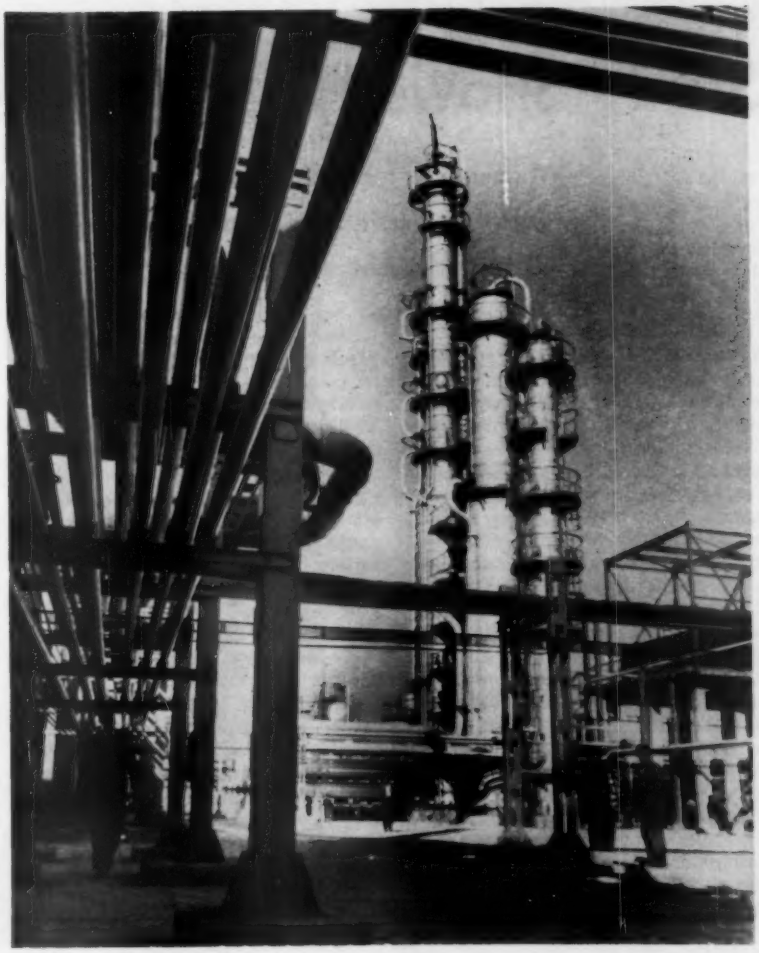
A HIGH-PRESSURE hydraulic cleaning unit which produces six streams of water at 10,000 psi. pressure will be used at Tidewater's Delaware refinery. Each of the streams is ⅝ in. in diameter and could bore through a ¼-in. steel plate.

The unit is equipped with a 350-hp. diesel engine, hydraulic torque converter and five-cylinder pump.



Big Stopper

GIANT SIGNS are being built by Humble on principal highways in the Southwest. The company hopes the 83 by 32-ft. board, which is six times as large as average billboards, is big enough to attract the attention of high-speed freeway traffic.



Romanian Fractionator

ADVANCES in refinery construction behind the Iron Curtain are indicated by a modern gas-fractionating installation at a refinery at Onesti, Bacau, Romania. The country's processing capacity has risen to more than 240,000 bbl. daily.

Profile of Best Service Station Dealers

Sales:

- Average 32,000 gal. of gasoline monthly.
- Move from 150 to 315 gal. of motor oil.
- TBA income is from $200 to over $4,000.
- Services, such as wash, lube, mechanical repairs, bring in an average of more than $725.
- Half of business is done on credit cards.
- Trading stamps are given by only half.

Finances:

- Initial investment is about $5,000, and in two-thirds of cases no borrowed money is involved.
- Current investment averages $11,000.
- Net profit averages $700 monthly.

Management:

- Company training taken by half.
- Employe-training plan followed by most.
- Incentive sales plan used by majority.
- Bookkeeping system used but usually not the one recommended by the supplying company.
- Sales promotions and advertising—both company sponsored and individually conceived—used extensively.

Personal:

- Dealer's average age is 38.
- He's at least a high school graduate.
- Hard work and service are his explanation for success.

Study Shows How Dealers Succeed

• What makes a successful service-station operation is indicated in a survey by Tulsa University. In general, the payoff is a result of good training, sound business methods, and hard work.

THE KEYS to operating a successful service-station business are sufficient capital, incentive plans, sales promotion, and good bookkeeping plus hard work and plenty of service.

These conclusions have been reached by Dr. Lloyd R. Saltzman of Tulsa University's marketing department.

They are based on an exhaustive survey of 75 successful operators selling products of 11 oil companies in the Tulsa area. Aiding in the study were 18 students of Dr. Saltzman's marketing class.

The supplying oil companies furnished names of their most successful dealers to Dr. Saltzman for the survey. In addition each company gave the names of two dealers considered the No. 1 and No. 2 operators in the Tulsa area.

Results of interviews with the elite dealers are compiled in the profile above. Averages for all the dealers show a slightly lower level of success.

The average monthly profit of all the successful dealers is $650 from gasoline sales of 20,000 to 25,000 gallons and oil sales ranging from 100 to 300 gallons. Their average monthly TBA sales are $750 and average income from all services $725.

The differences between the averages of the top-bracket dealers and others in the successful category thus are slight. Basically they fit the same pattern.

Low morale . . . Service-station operators have one of the highest turnover rates in the nation—about 30% per year.

Dr. Saltzman pointed out that dealers could improve their chances of success by following methods used by a majority of the successful dealers.

He said that the consensus in recent surveys of gasoline retailing is that "the morale of far too many service-station operators is low." He added "there is too great a mistrust on the part of the operators and oil-company representatives toward each other."

His advice to established dealers:

. . . **Cooperate** in sales promotions recommended by the company.

. . . **Practice better selection** and training of driveway salesmen to get a better employe.

. . . **Use an incentive plan** that will cause the men to work better and earn more money.

. . . **Develop a simpler,** easier way to keep records.

. . . **Keep in a good cash position** by not getting too far in debt.

. . . **Develop a balanced sales program,** including sale of TBA products, minor repair, and oil and lube jobs.

For the beginner . . . The man just entering the service-station business, according to Dr. Saltzman, should have from $2,000 to $5,000 of his own money to invest.

He observed that new lessees with little or no money of their own almost inevitably end up going bankrupt within a year or two.

About 61% of the successful deal-

ers interviewed did not borrow money to get a start. Dr. Saltzman believes this is a very important factor.

"For most dealers, the task of making a profit is quite difficult without the added burden of repaying borrowed money from suppliers and others," he said.

The average initial investment of the successful dealers was about $4,500 which has grown to a present average investment of $7,500 to $8,500.

Dr. Saltzman also advised new dealers to study the proposed service station and any agreements carefully before completing plans. Some new dealers find out too late that the old equipment and inventory left isn't what they thought it to be. The less money the prospective dealer has, the less he should expect to go into debt in order to buy lots of equipment, including a brand new pick-up truck.

Other bits of advice:

... **Insist on the best** and most thorough training possible.

... **Attempt to forecast sales** possibilities and potential profits. A knowledge of the minimum sales of gas, oil, TBA, and service required to break even on expenses each day, week or month would be extremely helpful in increasing the dealer's chances for success.

... **Consult several men** recognized as the best dealers in town in addition to discussions with suppliers before investing.

Role of oil company ... The supplier oil companies should improve their method of selecting dealers to reduce the wasteful fatality rate.

He suggested that the aid of qualified psychologists be enlisted in preparing a weighted application blank based upon the characteristics of the best dealers. All prospective dealers should complete the form, and a minimum score should be attained before the dealer could qualify as a lessee.

Dr. Saltzman said he believes such a procedure would help greatly in reducing the number of misfits now permitted to operate service stations simply because the company did not want to have a vacant station on its hands.

The marketing professor also suggested that oil companies gradually eliminate the submarginal lessees and operate fewer but more profitable service stations. Large numbers of stations, he observed, are not always the answer to a more profitable operation for both the oil company and the dealers.

His other suggestions:

... **Train oil-company salesmen** to work more closely with the dealers. The lessees' mistakes should be analyzed and possible solutions suggested before it is too late. A competent company salesman has the power to help save many dealers from bankruptcy.

... **Develop easier-to-keep** record systems. A one-page daily report sheet would be ideal if it is simple, easy to prepare and still gives minimum information for tax purposes and cost-sales analyses. The systems now suggested by the companies are not being used by most dealers.

What dealers say ... Main factors for success, according to the dealers themselves, are hard work and good service.

In addition a fairly wide range of reasons were given for success, including good record keeping, location, incentive plans, and training.

The dealers offered an equally wide range of suggestions on how oil companies could help them more. Mentioned most often were more advertising and promotion, greater margins of profit, more personal interest in the operators, and sale of company products through company authorized dealers only.

California Fire Flood Starts

MOBIL OIL CO., apparently satisfied with a pilot thermal recovery project completed 2 years ago, has started a new fire flood in California.

The project has been launched in the Moco sands at 2,100-2,600 ft. in Midway-Sunset field in Kern County, California. Eighteen wells which produce a 14° to 15°-gravity crude are involved in the Moco project.

Mobil's latest fire flood is considerably deeper than the pilot flood in South Belridge field. Shallow sands at 700 ft. were involved in this earlier project. And only four producing wells and one injection well were involved.

The company has been injecting air into one well at Moco for several weeks, but has released no information on the progress of the project.

In the South Belridge experiment, Mobil recovered about 50% of the oil in place within 18 months. This is several times greater recovery than expected under normal conditions and in much faster time (OGJ, Sept. 1, 1958, p. 107).

Mobil spent about $1 million on the South Belridge project, but apparently some of the problems encountered in this pilot flood have been worked out to the point that the Moco project will be more economical.

The company's fire-flooding program started several years ago with research done by the old Magnolia Petroleum Co. in Texas. The laboratory work was then field tested in Oklahoma and the first pilot operation moved to California to the low-gravity South Belridge field.

Montreal Pipeline Getting Close Study

THE long-standing proposal for a pipeline to carry Alberta crude oil to Montreal is reportedly getting some really serious consideration from the Canadian Government.

But the signs still indicate no final decision is expected in the near future. Informed sources in Ottawa said last week the industry will be given more time to improve crude production before a ruling is made.

This was in line with a recent statement by Trade Minister George Hees, who said there would be no snap decision (OGJ, Nov. 7, p. 104).

Last year the Borden commission recommended that the industry be allowed 18 months to raise production to 700,000-bbl. daily.

The deadline falls at the end of next month and production is hovering around 550,000 bbl.

Informants said considerations by a cabinet committee cover the merits of any type of pipeline—financed privately or otherwise—that could bring Alberta crude to Montreal refineries now using cheaper seaborne imports from Venezuela and elsewhere.

They said it appears that neither the government nor Canadians generally are satisfied that the industry as a whole has done all it can to meet the suggested production target.

One way of making a final effort to secure the industry's cooperation, in the view of some sources, would be to have the government say publicly that it takes a most serious view of the whole situation.

Main proponents of the Canadian crude pipeline are independent companies. The opponents, generally the big subsidiaries of international firms, say that any elbowing of imported crude out of the Quebec market would run up consumer costs and add little to Canadian crude consumption.

Foreign Profits Should Drill U. S. Wells

• This is the theory advanced by Houston independent Mike Halbouty. He says domestic search must be stepped up to keep reserves ratio in balance.

A HOUSTON independent scheduled to talk about the evils of oil imports told a California audience the domestic-oil industry can't blame all its problems on the excessive flow of foreign oil into the U. S.

Michel T. Halbouty said the domestic industry's problems are partly due to "unfair competition" from natural gas and poor conservation practices in the major producing states of Texas, Oklahoma, Louisiana, Kansas, and California.

The outspoken Halbouty expressed these views at the annual meeting in Los Angeles of the Pacific sections of AAPG, SEG, and SEPM.

As far as imports are concerned, Halbouty offers this solution: Let the big importers spend the money they are making from cheap foreign oil to find new reserves in the U. S.

Oil men are "stealing from ourselves" by selling gas so cheaply, he said. He pointed out that while crude oil sells for $3 a barrel at the wellhead, the equivalent amount of energy in the form of gas sells for only 68 cents a barrel.

The Houston oil man was particularly critical of the conservation policies of his home state of Texas. He said Texas operators are permitted to drill unnecessary wells, a practice leading to lower allowables, fewer producing days, and poor reservoir conditions.

"This places Texas producers at a well-cost disadvantage with their fellow producers in such states as Utah, Arizona, New Mexico, and Colorado," he said.

Wildcatting needed . . . Halbouty said there is a definite need to find new oil in the U. S. despite the big discoveries being made abroad.

Without a stepped-up exploration program in the U. S., he said, the country faces the prospects of getting the reserve ratio out of balance and ending up depending more and more on foreign sources.

He cited three forecasts which point to the need for more exploration in the U. S.

One is a recent report by Sir Stephen Gibson, chairman of the World Petroleum Congress and former president of Iraq Petroleum Co.

Gibson said the world's known reserves of 275 billion barrels will be consumed by 1985 and that this much in new reserves must be found during the next 25 years.

"He added a significant footnote by saying no more than 75 billion barrels of that 275 billion barrels of oil would be found in the Persian Gulf area," Halbouty said.

As a second source, Halbouty said "an economist of note" recently forecast the U. S. would need to find 52 billion barrels of oil in the next 10 years to enter the 1970's with the present reserve ratio.

He then referred to predictions made by David T. Searls, general counsel of Gulf Oil Corp. Searls has estimated the demand for natural gas will almost double in 10 years, hitting 18 to 21 trillion cubic feet annually.

Michel T. Halbouty
. . . make it abroad, spend it in U. S.

Searls has estimated, Halbouty said, that the U. S. needs to find 205 trillion cubic feet of reserves to meet this demand in the next 10 years and an additional 100 trillion cubic feet to maintain the present reserve ratio of a 20-year supply.

It would take 625,000 wells to find the 205 trillion cubic feet of gas and an additional 300,000 wells to find the other 100 trillion cubic feet, according to Searls' estimates.

Halbouty pointed out that this requirement for 92,500 wells a year calls for more than twice the 44,000 completions expected in 1960.

"We must recognize the obvious facts being presented by men of vision and utilize today's profits from relatively cheap foreign oil to explore for and find the domestic oil and gas we know we will need tomorrow. . .

"Should the importing companies start converting profits from foreign oil into domestic exploration—and this seems a perfectly logical and wise thing to do—they could stimulate the industry which made them all big and successful corporations, and they could utilize the services, the genius, and the know-how of the men they are laying off, retiring early, and terminating."

Oil Discovery or a Gas Field?

TEXACO INC. has come up with a gas well in its first offset of a gas-well-turned-oil-well in California's Sacramento Valley.

If the new well follows the pattern of its predecessor, it will flow gas for about 6 months then start flowing oil.

The first well was completed in September 1959 as a gas well, but by mid-April it started producing 32°-gravity oil (OGJ, Aug. 29, p. 53). The oil is the only oil production in the entire Sacramento Valley.

The two wells are located in Solano County in the southern portion of Winters gas field. The oil flow in the first came from two intervals between 5,502-85 ft. A 1-hour test of this interval in the second well produced a gas flow of 1,600 M.c.f. daily through a $\frac{7}{8}$-in. choke.

Texaco has shut in the new well, the McCune 2, and probably will do more drilling to determine whether it has a bona fide gas pool or the valley's first commercial oil field.

Stunned Firms Deny Arab Claim on Prices

• Companies say they have not agreed to prior consultation with Middle East countries on price changes. Arab League official also says firms will find ways to cut prices without affecting revenues of producing countries.

WESTERN oil companies operating in the Middle East have almost become immune to surprise, but an Arab League spokesman tossed them a shocker last week before the dust could settle from the controversial Beirut Oil Congress.

Mohamad Salman, Director of the League's Petroleum Affairs Committee, told the Beirut press the oil companies had agreed to consult the governments of producing countries before making any changes in oil prices.

The "it just isn't so" reaction from San Francisco, New York, and London was immediate, but anonymous and couched in careful language. No oil company was talking for the record, but all were puzzled by the Salman statement.

The Arab League official gave the impression that the companies had agreed to follow a resolution passed by the Arab Oil Congress in which the producing countries insisted that they be consulted before any change is made in posted prices.

The resolution, the second annual Arab refrain on the same score, was the fruition of a great deal of expressed bitterness at the Arab meeting in Beirut. The more vocal Arabs make no secret of their resentment of recent sudden cuts in posted prices for Middle East oil.

Arab income from oil is based on these posted prices and they are demanding louder and louder at each opportunity that they have a right to be consulted before prices are cut.

Congress follow-up . . . Less than 2 weeks after the second Arab Oil Congress closed at Beirut without any western oil company committing itself to any price consultation, Salman called a press conference in the same city.

He read a prepared statement saying his purpose was to review the results of the congress, progress on achieving Arab aims, and the over-all advances of the Arab oil unity.

"Discussions between the delegates took place in an atmosphere of frankness and profound understanding of oil problems," Salman told the Beirut press, a comment that probably would puzzle a great many western delegates to that congress.

Mohamad Salman
His sources were not identified.

"The conference adopted four resolutions which, though few in number, have far-reaching implications," Salman continued.

Then he delivered the shocker which is puzzling the oil companies which operate throughout the Middle East.

"I am pleased to announce so soon after the completion of the work of the second Arab Petroleum Congress that I have heard from reliable sources that if the oil companies find it necessary to reduce prices in the future, they will work out new ways of doing so which will not affect the revenues of any oil-producing state, and that they will take no step before consulting and obtaining the approval of the oil exporting countries. This is indeed a great gain for these congresses."

After making the statement, Salman refused to elaborate on just what the "new ways" of reducing prices without affecting oil-country revenues would be. He also declined to identify his "reliable sources" but Beirut newsmen said he left the impression the sources were the companies themselves.

A misunderstanding? . . . In London, oil spokesmen commented almost immediately that they were afraid Salman misunderstood the policy of the companies on price consultation.

The British spokesmen pointed out that the resolution calling for such pricing talks was passed by the Arab heads of delegations to the congress in private meetings which were not attended by oil company representatives. The resolution was presented formally at the final session of the congress without any discussion from western delegates.

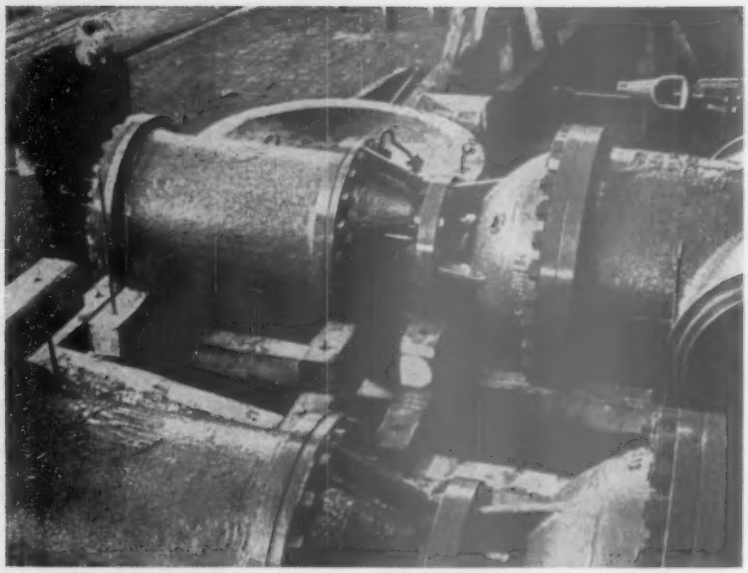
Privately, the westerners who attended the congress made it very clear in corridor conversations with Arab delegates that they still regard it as impractical, if not legally impossible, to consult with governments before making price changes.

This is particularly true of the American companies that have interests in Middle East oil-producing countries. They were quick to point out that such consultations would make them liable to anti-trust prosecution under United States' laws.

This stand brought only derisive replies from Arabs such as Shaikh Abdullah Tariki of Saudi Arabia who pretty well summed up the general Arab reaction by saying:

"What interest do we in Saudi Arabia have in U. S. laws? These companies are operating for us in our country. Do we have to accept the laws of their home country as well as them?" (OGJ, Oct. 31, p. 52).

After making their position known unofficially, western company representatives were still puzzling last week over the Salman press conference and who, if anyone, indicated to the Arab leader that they will go along with price consultations.



VALVES for Comecon line are being manufactured in East Germany

Soviets Working on Big Line

. . . to move Second Baku oil to the west. Some control equipment is being procured outside of Russia.

RUSSIA is turning to its satellites and western Europe for control equipment for the 2,800-mile Comecon pipeline being built from "Second Baku" to eastern Europe.

Rotork Engineering, a British firm, will supply valve control equipment for the system under license from Nuovopignone, a subsidiary of Italy's ENI. This is part of a $200 million deal between Finsider, an Italian steel manufacturer, ENI and Russia (OGJ, Oct. 31, p. 75).

Russia will ship 60,000 bbl. daily of crude to Italy as its part of the barter compact, while ENI will send synthetic rubber and pumping equipment. Finsider will ship 240,000 tons of pipe.

It was not learned immediately how much of the pipe or equipment, in addition to the valve-control gear, will be used directly on the Comecon system. But the shipments in any event will free Russian plants to devote more output to the project.

A valve plant at Magdeburg, East Germany, is already building slide valves for the pipeline system.

About two-thirds of the 2,800-mile system will lie in Russia itself, and the Soviets plan to start construction within their borders soon. Initial shipments of crude from Volga-Ural fields are scheduled to start moving through the southern branch of the system next October. By 1965 the system will be supplying about 300,000 bbl. daily to Czechoslovakia, Hungary, Poland, and East Germany.

Construction progress . . . The Russians have set up a construction base at Lvov in western Ukraine, and the initial shipment of pipe has arrived in the area. The first section will be built southwestward from Mozyr to the Czech border.

Crews finishing up a natural gas line from Dashava to Minsk, in the same vicinity, are being reassigned to the Comecon project. The initial section will form the southern branch of the over-all system, which will supply Czechoslovakia and Hungary.

Czech crews started laying a 250-mile section in September last year. Spreads have been slowed by wet weather and equipment breakdown. But the timetable remains unchanged. The first shipment of Comecon crude is scheduled to reach a refinery at Bratislava in October 1961.

Hungarian crews began preliminary work on their 80-mile section this summer.

In Poland, spreads are active both east and west of Plock, a town northwest of Warsaw, where a major refinery and petrochemical complex is being built. About 450 miles of the northern branch will run through Poland to Schwedt, East Germany, where tankage and other facilities are under construction on the west bank of the Oder River.

The northern branch of the Comecon system will open after the southern link.

The Comecon name is taken from a joint economic association of Russia and its satellites known as the Council for Mutual Economic Aid.

Iran Export Capacity Boosted

THE SHAH of Iran last week took time off from enjoying the role of fatherhood to dedicate a major new export terminal at Kharg Island on the Persian Gulf.

The ceremony was in the shadow of the country's jubilation over the birth of the first son and heir to the Shah's throne. But the official opening of the terminal gives Iran more than 300,000 bbl. daily additional export capacity and opens another big Middle East field to big-scale production.

The $140 million terminal and pipeline system from Gach Saran field was built by the consortium group of companies in a 3-year program. It will permit output from the field to increase from 60,000 bbl. daily to more than 300,000 bbl. daily.

The terminal will handle the biggest of the new tankers and is further down the Persian Gulf from other Iranian terminals, reducing round trip mileage to consuming centers. Gach Saran crude, at 32.3°-gravity, is the heaviest of any Iranian crude, an advantage in Eastern Hemisphere markets.

A 72-mile, 26-28-in. pipeline runs from Gach Saran to Ganaveh, on the Persian Gulf. A 25-mile 30-in. submarine line extends from Ganaveh to Kharg Island. The system initially has a design capacity of more than 300,000 bbl. daily without pumping stations.

Gach Saran is one of the most important reservoirs in the Middle East. Output of 60,000 bbl. daily from four producing wells for years has made only a small dent in the reserves. The 7,200-ft. oil column is one of the thickest, if not the thickest, of any known field.

Big Indian Oil Gains Forecast by Russian

• Prospects in the Cambay area are bright, a Soviet advisor says. He predicts the country's local supplies will meet demand in 1965.

A TOP Russian oil man named Alenjikov, who has been close to the Indian oil industry, predicts that India will be self-sufficient for oil within 5 years.

The expert, who has been Soviet advisor to the Indian Oil Ministry and chief field engineer in the Cambay discovery area, said prospects are bright for Cambay and the area may be the site for the first refinery in the State of Gujarat. Commercial production in the Cambay area is expected to start in April.

If the forecast comes true, Indian output will jump from a scant 8,500 bbl. daily at present to about 280,000 bbl. daily by 1966. Production is going to increase to 65,000 bbl. daily when a pipeline system from Nahorkatiya field in Assam opens. But the remaining 215,000 bbl. daily remains to be developed.

The Russian has had an important role for 3 years at Cambay, where the government believes results so far indicate reserves on the order of those found at Nahorkatiya. These are estimated at 29 million tons, or more than 200 million barrels. India thinks the Cambay reserves will turn out to be between 20 and 40 million tons.

Cambay program . . . Field development at Cambay is being carried on with the help of Russian and Romanian equipment and crews. The Russians now are sending ten more rigs and crews to man them to western India. Most of these will be assigned to Cambay which is about 240 miles north of Bombay.

Nine producing wells have been completed, and the schedule calls for a total of 20 by March. Four wells, 7, 9, 11, and 14, are now making hole. Seven more will be spudded in the next few weeks.

Tests on Cambay 8 indicate a yield of 70 tons, or about 500 bbl. daily. No 7 is in the 60 tons, or 420 bbl. daily class; No. 4 appears good for 50 to 60 tons, or 350 to 420 bbl. daily. A heavy flow of gas was encountered in one well, and oil and steam flow from another.

Cambay structure covers about 17 square miles, and the government is developing the field with a 900 ft. spacing of infill wells.

A topping plant is under construction at the field and the government plans to start production on a trial basis in April. Deliveries of 1,500 tons, or about 10,500 bbl. daily are scheduled to start in July, if the railroad system can move that much volume to Bombay for refining at the Burmah-Shell plant. Some thought is already being given to a pipeline to Bombay.

Two of the new Russian rigs will be set up at Ankleswar field, 100 miles south of Cambay, where the government believes the potential may be better than Cambay. Test figures from the area have never been disclosed.

India hopes to start trial production from Ankleswar at the same time it starts making deliveries to Bombay from Cambay.

Drilling operations will start in December in two other areas. One wildcat will be drilled near Gandhinagar, the new capital of Gujarat State, and another at Baroda, where oil was struck in a test 2 years ago.

Argentina Gets Gas-Line Bids

. . . which include an offer by Texas Eastern to build and operate the largest transmission system outside U. S.

TEXAS Eastern Transmission Corp. has offered Argentina a complete package deal for the construction and operation of a $380 million pipeline system.

The company is the leader of a group that made the only offer to handle the entire project in a 1,050-mile natural-gas pipeline from Comodoro Rivadavia to Buenos Aires. The Texas Eastern move was disclosed when bids were opened for the project that will be the biggest gas transmission system ever built outside the U. S. and Canada.

The bid was submitted by Gasodar Soc. An., an Argentine company that will handle construction if the bid is accepted. Gasodar is set up to operate as a privately owned utility, with 50% ownership held by Argentine interests.

Gasodar is headed by Norbert A. McKenna, a former vice president of Dresser Industries International. He was quoted in Buenos Aires as saying his group plans to seek financing for the project from the Development Loan Fund, in Washington, and the Import-Export Bank. This move, if successful, would bring financing from these organizations into foreign oil operations for the first time.

Other bids, including an offer from Argentina, are on parts of the project.

Sun's First Pakistan Test Planned

SUN OIL CO. will participate in its first drilling venture in Pakistan in a joint venture with Pakistan Petroleum Ltd.

Pakistan Sun Oil Co., the local subsidiary, will have half interest in a wildcat at Dasori, about 35 miles northeast of Hyderabad in West Pakistan. The location is in the Sun concession area, but Pakistan Petroleum will be the operator.

A 5-mile road is now under construction to the well site, and a 12-mile 4-in. pipeline will bring water from the Nasir Branch of the Rohri Canal if closer sources prove inadequate.

The well is expected to be spudded by mid-December by a drilling crew now on Pakistan Petroleum's Lalmai 2 in East Pakistan. Some of the rig components will come from an outfit now drilling at Karsal 4, in northern West Pakistan.

Pakistan Sun acquired exploration rights on 10,000 sq. miles in the country 3 years ago. The rights are in five blocks, all located in the southern and southwestern part of West Pakistan. Under the contract, the Pakistan Government will share 25% of the initial exploration and development expenses.

The planned test will be the forty-fourth in which Pakistan Petroleum has participated.

Lubes Finished Without Clay

. . . in Ferrofining process developed by BP. First unit will be built at the company's Dunkirk refinery.

A CLAY-LESS process for making lubricating oils has been developed by British Petroleum Co.

The process, called Ferrofining, uses a specially developed catalyst that enables the use of hydrotreating as a finishing process not only for solvent-refined lubricants, but for straight distillate lubricants. These normally require treatment by acid and clay processes. Ferrofining eliminates the usual waste-disposal problem caused by spent clay and acid tar.

The first Ferrofining unit will be a 3,000-bbl. plant to be built at the Dunkirk refinery of BP's French affiliate. BP is also considering the addition of similar units at other refineries.

The process was developed at laboratories at Sunbury-on-Thames, England, and Dunkirk.

Extensive tests indicate Ferrofining produces lubricants with excellent resistance to oxidation, and with a suitability for specialty products. Ferrofined lubricants when formulated into gasoline-engine and diesel-engine oils match the performance of oil treated by conventional clay methods.

A feature of the fixed-bed process is that it operates at pressures below those of catalytic reformers. Thus, it is possible to operate without hydrogen compressors. Average hydrogen consumption runs about 25 cu. ft. per bbl.

The catalyst is a rugged three-component catalyst on an alumina base. In pilot plant operations a charge operated continuously for 13 months without any sign of reduction in activity. These operations also showed that contaminated catalysts could be restored by a simple burnoff with steam-air mixtures. Operating costs of the new Dunkirk unit are expected to be about 19.7 cents per barrel.

Iranian Rights Forfeited

A CANADIAN company that joined the rush for overseas concessions a few years ago is now giving up in Iran by forfeit.

Iran-Canada Oil Co., owned jointly by Sapphire Petroleums, Ltd., Toronto, and National Iranian Oil Co. reportedly will lose a $350,000 deposit for failure to carry out terms specified in a concession contract.

Sapphire secured rights on two small tracts totaling 386 sq. miles on the Gulf of Oman 2½ years ago. The terms were similar to agreements made with Iran by ENI, Italy's state-owned company, and Indiana Standard.

The company agreed to spend $18 million over 12 years, of which $8 million was to be spent in the first 4 years. The contract provided for a split in production with NIOC, and with a further split of its profits with the government.

Burma Oil Control

. . . is purchased by the Burmese Government.

THE BURMESE Government has taken control of the country's oil industry through acquisition of 51% interest in Burma Oil Co. (1954), Ltd.

The government increased its holdings from 33⅓% to 51% in the operating company in an agreement signed in Rangoon with a representative of three other owners. These are Burmah Oil Co., Indo-Burma Petroleum Co., and British Burmah Petroleum Co., which before World War II handled exploration, production, refining and marketing in the country.

The government has agreed not to increase its interests further for at least 15 years. Companies on their part agreed to put up 49% of the capital, or about $8.4 million, for an expansion of the 5,238-bbl. Syriam refinery, and a submarine pipeline across the Irrawaddy River.

The companies also will spend $5.6 million per year on exploration for at least 3 years. The country now produces about 10,500 bbl. daily, which is processed at Syriam and Chauk refineries with a combined capacity of 9,638 bbl. Neither production nor refining capacity will be able to satisfy growing demand much longer, and the country may have to start relying on imports next year.

FOREIGN BRIEFS . . .

A styrene plant capable of producing 25,000-30,000 tons a year will be built at Lillebonne, France, for Ethyl-Synthese by Societe Belge de L'Azote et des Produits Chimiques du Marly, Liege, Belgium. The unit will use a technique granted by America's Koppers Co., Inc.

A Houdry dehydrogenation process unit with a nominal design capacity of 20,000 short tons of butadiene a year is on stream at ANIC of Italy in Ravenna, Italy. At the same site ANIC has a plant for synthetic rubber, of which butadiene is a vital ingredient.

Russia has completed one of the top priority natural gas pipeline projects in the current 7-year program. This is a 405-mile system running northward from Saratov to Gorki, two cities on the Volga River. Construction took about 1 year. The line will be extended 340 miles northwest to Cherepovets next year.

Esso AG plans a $12 million petrochemical expansion program at its 72,000-bbl. Cologne refinery that will double the yield that can be used as petrochemical feedstocks from 7 to 14%. Existing facilities can produce 45,000 tons per year of ethylene, 35,000 tons per year of propylene and 7,500 tons per year of butadiene.

A new Israeli marketing company has sold 50,000 tons of diesel fuel valued at about $1 million to Scandinavia in a program to develop export markets for products from the Haifa refinery. The company, United Petroleum Export, is owned jointly by the country's three marketers and Paz Oil Co., owner of the refinery. The oil will be transported in Israeli flag tankers.

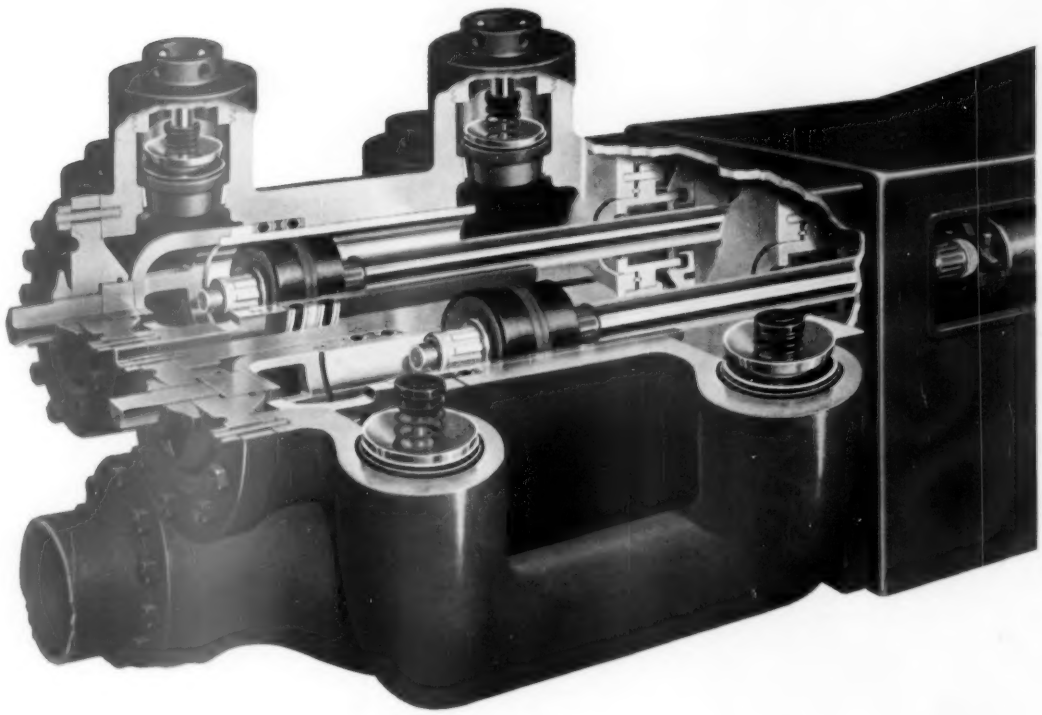
Northern Ireland's first refinery, a 30,000-bbl. plant, will be started next year by British Petroleum. The plant, involving an initial investment of $22,400,000 will be on the Musgrave Ship Channel near Belfast. Construction will be completed in the spring of 1963.

Polyethylene and carbon-black facilities may be built at the Haifa refinery. Negotiations for the units are in the final stages between American backers, Paz Oil Co., and the Israeli Government.

A natural-gas pipeline is planned from Qatar's Dukhan oil field to the capital at Doha. The 50-mile 10-in. line will supply gas to power-generation and water-distillation plants. It is scheduled to go into operation in March 1961.

The "Inside Story" of the Heart of Your Rig

. . . by MISSION



This cutaway view of a mud pump shows where the vital Mission fluid-end parts fit and why they are essential to correct operation. Forces on these parts are staggering. For example, pistons and rods may be subjected to forces of more than 100,000 pounds.

Liner packing and gland packing may be exposed to pressures exceeding 2000 psi, and valves and seats are required to stand violent impact every time they close.

Liners, also, are subject to "rocking," which aggravates both piston and liner packing wear unless all critical liner dimensions are held within API specifications.

These forces may be multiplied by shock loading at times, and they are completely reversed at least once every second. When you remember that mud may contain abrasive sand to cut metal parts, corrosive chemicals to pit them, and oil to attack rubber, it seems obvious that only the best pump parts stand a chance.

These Mission Pump Parts are in direct working contact with the drilling fluid, so it is easy to see that they are vital to correct pump operation. When you remember that they work together for trouble-free service, it makes sense to specify *all* Mission Pump Parts—exclusively—in all your pumps. Your pumps will perform better, require fewer repairs and cost less to maintain when you do. The famous Mission Guarantee assures you of this service.

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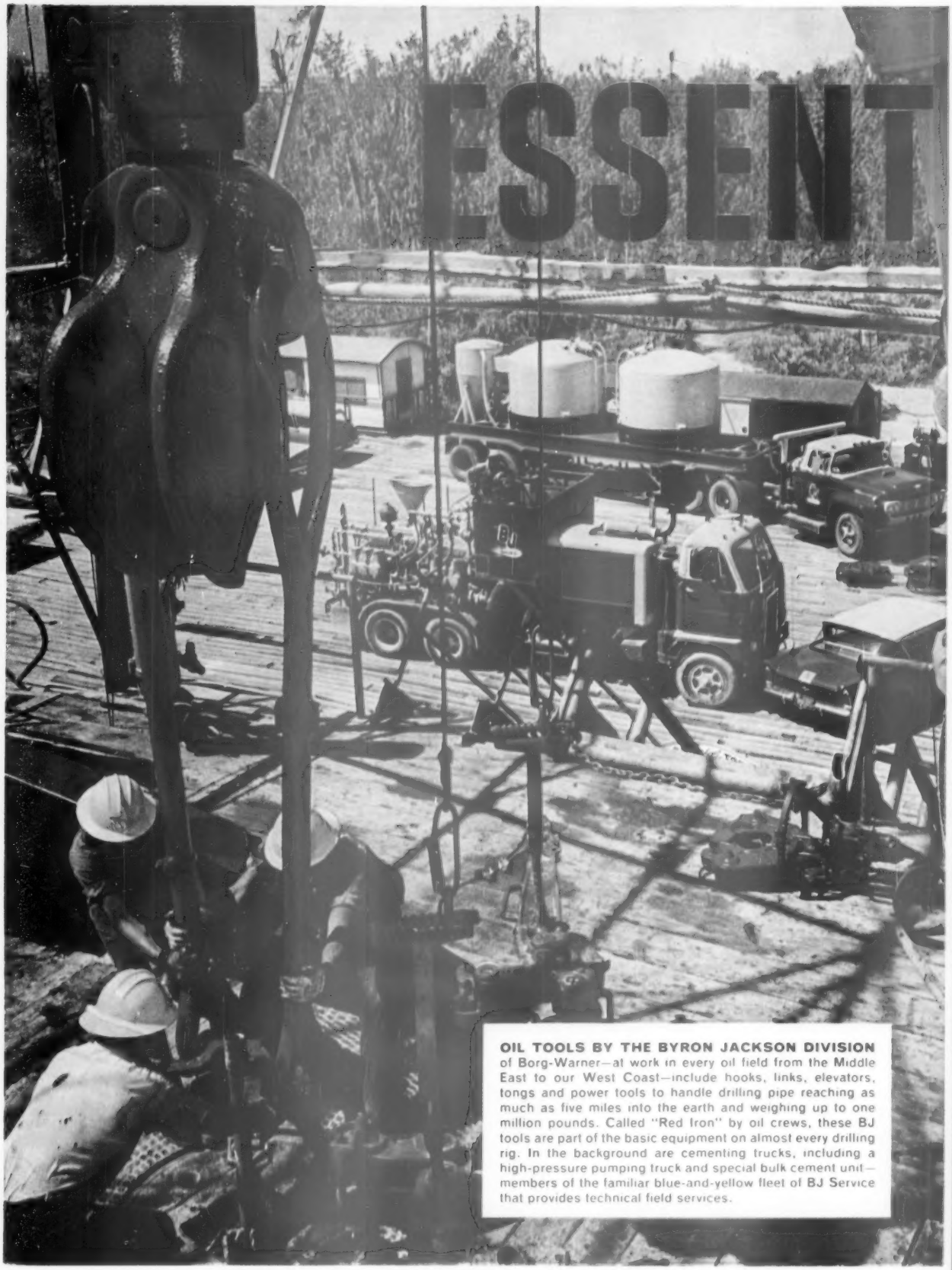

OIL TOOLS BY THE BYRON JACKSON DIVISION of Borg-Warner—at work in every oil field from the Middle East to our West Coast—include hooks, links, elevators, tongs and power tools to handle drilling pipe reaching as much as five miles into the earth and weighing up to one million pounds. Called "Red Iron" by oil crews, these BJ tools are part of the basic equipment on almost every drilling rig. In the background are cementing trucks, including a high-pressure pumping truck and special bulk cement unit—members of the familiar blue-and-yellow fleet of BJ Service that provides technical field services.

IALS

BY BORG-WARNER

Among the 7 Hats of Borg-Warner
—a helmet to symbolize our contributions
to the oil, steel and chemical industries

Without the tools and techniques of man, our country's huge reservoir of oil would remain untapped today. How valuable would a deposit of iron ore be without men and machines to make steel? Not even Nature herself can equal the qualities of such modern synthetic materials as plastics.

Partner to the growth and progress in oil, steel and chemicals are many of the divisions and subsidiary companies of Borg-Warner Corporation. B-W's Byron Jackson Division, for example, has long been the pacemaker in special tools required to drill oil wells which must probe miles below the earth's surface. BJ Service crews and equipment provide the cementing and treating techniques which keep these wells healthfully productive . . . and BJ centrifugal pumps supply the pulsing power for pipelines, refinery, chemical and metal-making processes.

Three B-W divisions—Ingersoll Steel, Calumet Steel and Franklin Steel—produce such quality specialty steels as stainless, alloy, tool and saw steels and bar mill products. Marbon Chemical Division is responsible for the creation of Cycolac®, the Borg-Warner plastic whose balance of properties make it truly unique, along with reinforcing resins and rubber-to-metal adhesives for the rubber industry and synthetic resins for the paint industry.

The years ahead promise a growing need for oil, steel and chemicals—and promise, too, even greater service to these industries by Borg-Warner.

B-W

The 7 Hats of Borg-Warner . . . (top) national defense; oil, steel and chemicals; (middle row) agriculture; industrial machinery; aviation; (bottom) the automotive industry; home equipment.

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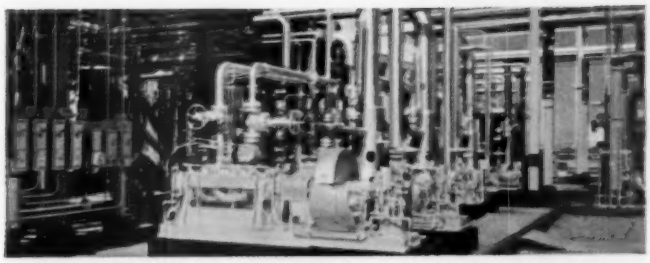
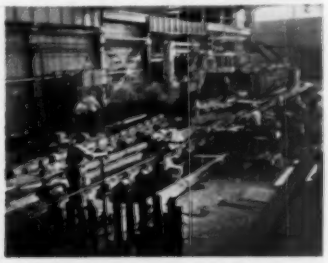


PUMPS BUILT BY BYRON JACKSON are equally at home handling hot oil at 800° refinery temperatures (as shown above) or in feeding low-temperature liquid oxygen (−320° F.) to a modern steel furnace. Serving almost every phase of the oil, steel and chemical industries, BJ pumps transport essential fluids . . . provide water under pressure for cleaning, cooling and secondary oil recovery . . . push petroleum products through thousands of miles of pipeline "arteries."

STAINLESS STEEL, solid and clad—processed for exceptional forming abilities—is just one of the steels made by Ingersoll Steel. A modern specialty mill, Ingersoll is geared to meet customers' analysis, size, gauge, finish "specs"—exactly, economically.



STEEL BARS AND SHAPES rolled by Calumet and Franklin Steel Divisions meet exacting specifications of the construction, farm equipment, material handling and automotive industries. Other steel products: fence posts, tubing, special-use sections.

"BETTER IN MORE WAYS THAN ANY OTHER PLASTIC" sums up why hundreds of consumer and industrial products use Cycolac—the tough, hard, rigid ABS plastic developed and produced by B-W's Marbon Chemical Division. Familiar products easily and economically molded from colorful Cycolac pellets include (left to right) portable cooler, safety helmet, transistor radio case, portable mixer housing, telephone, typewriter housing, luggage.

WHAT BORG-WARNER MEANS TO YOU!

By making parts and materials that go into a great number and variety of finished products, Borg-Warner influences the activities of the American family. On a fall afternoon, helmets that protect football players might well be molded of Cycolac. Auto fuel that transports spectators to the site of the game is very likely refined with the help of Byron Jackson pumps. And, without a doubt, the car itself contains parts made by any one of many B-W divisions. Wherever you live, work, play or travel, Borg-Warner touches your life importantly every day.

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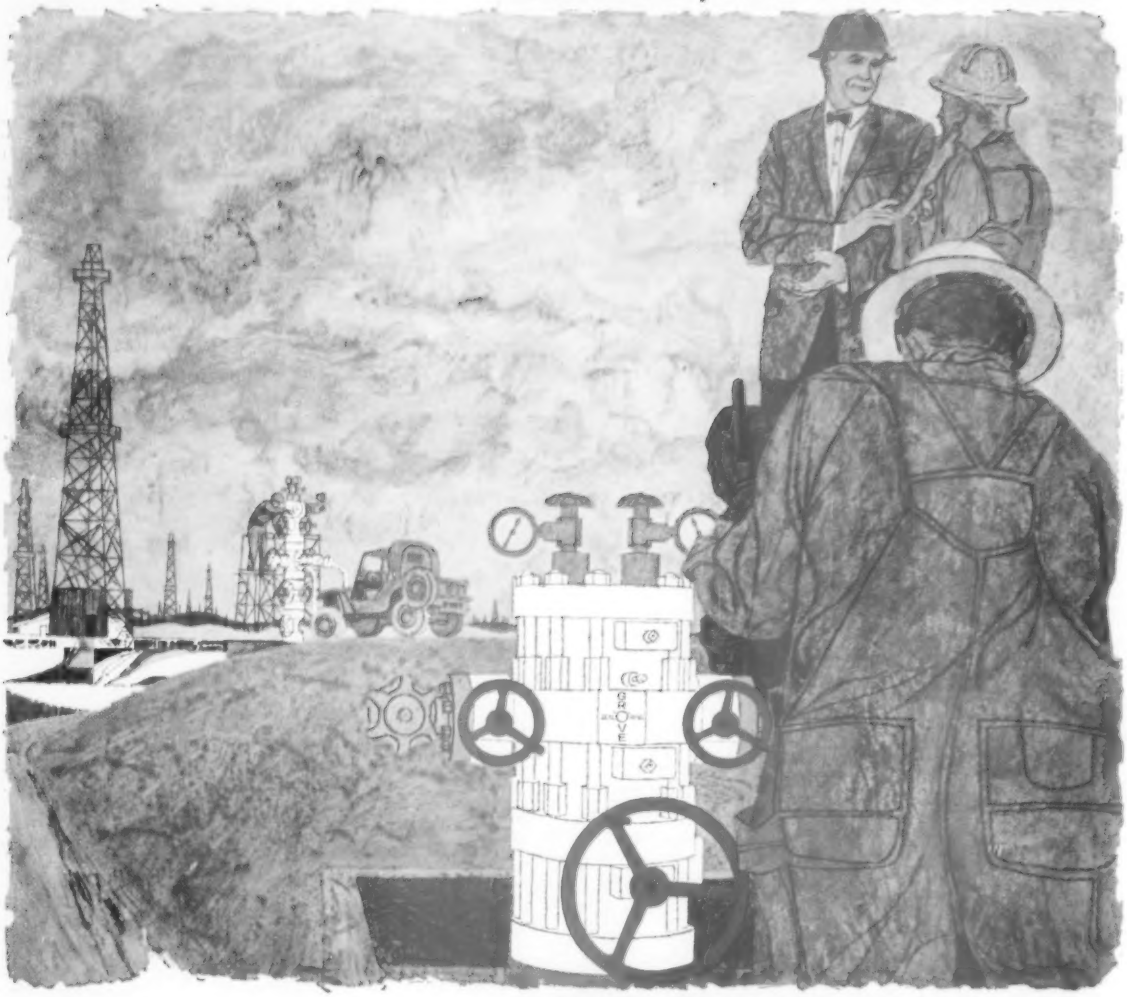

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OPERATION "Cost Cutting"

Journal report on how the industry is meeting today's most challenging problem: Making a profit

THE OIL INDUSTRY is not what it was a few years ago—it has undergone some distinct changes that are basic and long-lived. A new set of rules must be recognized and operations adjusted accordingly.

The domestic oil industry is presently geared to a slower rate of increase in demand. For years it expanded across the board, by 6% or more per year. From now on, at least for the foreseeable future, the rate will be lower—more like 3% per year.

However, any impression that petroleum has ceased to be a growth industry should be thoroughly discounted. The long-range prospect is for substantial, continued expansion of demand here in the United States. The oil industry has become a more mature industry, with demand for products more nearly related to population increase and to Gross National Product.

An important factor in this modified rate of growth is the saturation of new markets. Oil has gone about as far as it can go in displacing coal for power generation, space heating, and railroading. Now in turn, oil is seeing some of these markets being invaded by natural gas.

But that isn't the whole picture. There is for the first time a consumer revolt against high taxes. Gasoline, loaded with an unreasonable 50% retail tax levy, has reached a price level which has made the American motorist economy minded. There will be a steady increase in gasoline demand, but the rate is going to be shaved by the introduction of the compact cars.

In still another area, oil is paying the price of progress. The consumption of automotive lubricants is dwindling with the adoption of self-lubricated bearings, and sealed systems. All jet planes now use synthetic lubes instead of petroleum fractions. Offsetting these losses are gains now being made in new markets, principally petrochemicals.

Swift pace. As the steward of more than 65% of all the energy consumed in this nation, the oil and gas industry has followed a swift, progressive pace. That pace is hard to slow down.

Oil companies must project their operations far down the years. For it takes years to translate investments in seismic exploration into returns at the gasoline pump. As a result, the industry built up a massive momentum. When the unexpected happened, the industry simply overshot the mark.

This calls for overcorrecting—and the expedients of the day are to be found in cost cutting.

One painful form of cost cutting is temporary retrenchment. The effects of this necessary step show up in the abrupt decline in exploration and drilling. Many companies who hedged against the prospect of being caught short in their capacity to meet projected demands, have sharply reduced payrolls by attrition, early retirement, and layoffs. In a number of cases, mergers and consolidations have been undertaken to trim overload.

Another, more positive, aspect of cost cutting concerns doing the job better. Now as never before, oil executives are acutely aware of the need for higher efficiency. And never before have they

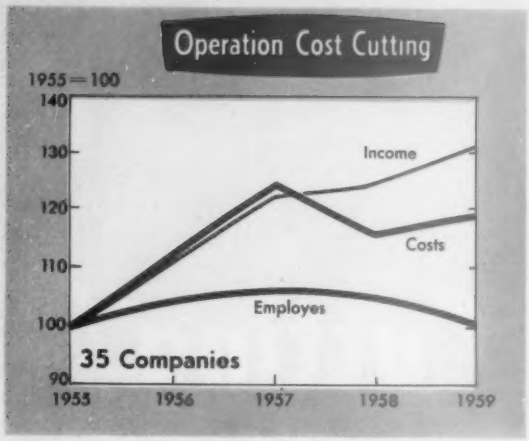


Fig. 1.

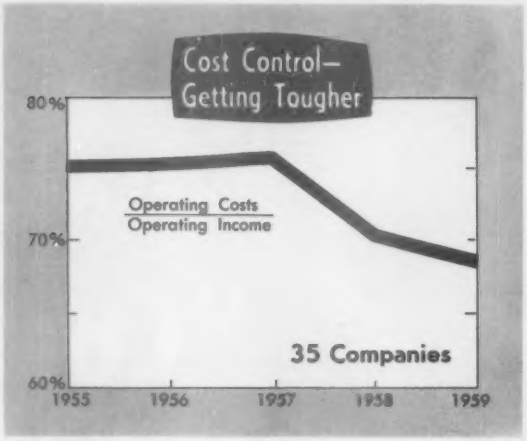


Fig. 2.

been offered such a wealth of technical tools for accomplishing these ends.

Over-all record. Fig. 1 shows the recent cost-cutting record, taken from a study of 35 U. S. majors and independents. This group represents a daily crude produtcion of 8.9 million barrels and a refining level of 10.4 million barrels both here and abroad.

This figure concerns total employes, gross operating income, and operating costs excluding interest, taxes, depreciation, etc.

Note how operating costs kept pace with gross income during the first 3 years, a warning of the need for more attention to operating economies. When income broke sharply in 1958, the overdue reaction on costs was evident. The reduction in employes is still continuing this year.

The 1958 break in costs with relation to income is more sharply defined in Fig. 2. This reduction came about largely as a result of cutbacks in exploration, development drilling, and in payroll paring. These were the expedient measures. They cannot be expected to have much further effect in massive cost reduction. As the industry trims to the new pace of operations, it needs to turn to other means for cost cutting. From now on, opportunities lie more in the direction of new techniques and new concepts of operation designed to boost efficiency in all divisions.

Exploration Cuts

When hard times arrive, one of the first phases of operation to feel the economy knife is exploration, as shown in Fig. 3. While there are those who doubt the wisdom of this, it remains a hard fact. Exploration is subject to quick and easy cost cutting.

The past 2 years have seen severe cutbacks in exploratory expenditures, chiefly in the fields of drilling, personnel, and field parties, both seismic and geological. As a result, the geological profession is in the throes of an unemployment siege unparalleled in its history. Geophysical activity is down 8.6% in the free world. Hardest hit is Canada where total geophysical work has dropped about 25%.

In the field of personnel, many approaches to economy have been put in force. Fewer new men are being hired, older ones are being retired early, and many others are being released. Centralization of division and district offices paved the way for most of these cuts in personnel.

Many other economy measures are tinged with a flavor of "more work with fewer people." These include a greater reliance on subsurface geology. This remains the cheapest approach to finding oil, as contrasted with geophysics, the most expensive.

In new oil frontiers, of course, geophysics continues to dominate exploration methods, for lack of subsurface data.

Smaller crews. A potential saving in seismic work is the use of fewer members to the crew. Some companies and contractors have learned how to operate efficiently with the so-called "stub crew" of five members (Fig. 4). Lighter and more portable field equipment, plus increased emphasis on more elaborate equipment in the home office, has contributed to this grasshopper type of operation.

Another important lesson the industry is learning deals with leasing. In the fever of competition, lease bidding has clearly gone beyond reason in a

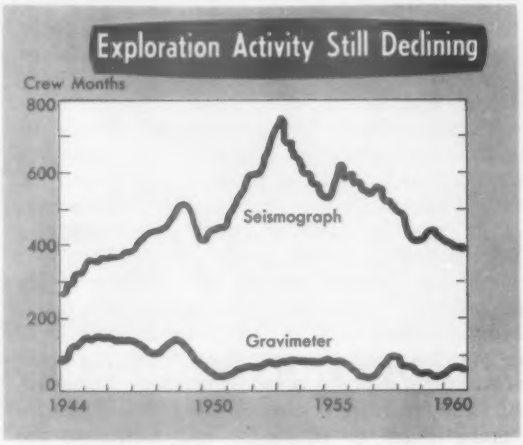
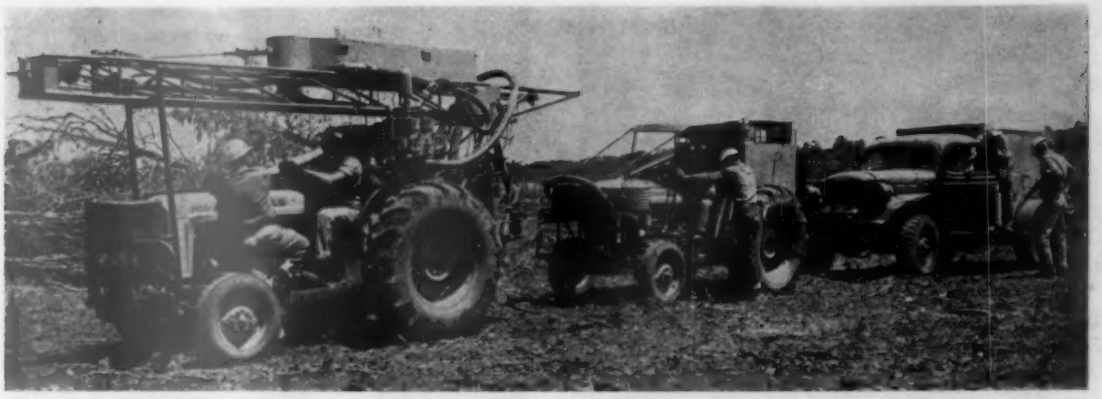


Fig. 3.



STUB CREW can operate efficiently in seismic work and save money at the same time. Fig. 4.

number of instances in the past few years. Witness some of the prices paid for acreage in the Four Corners in Nevada and North Dakota, and offshore in the Gulf of Mexico.

In one competitive offshore sale, the winning bid was nearly 10 million dollars higher than the next highest. In some areas of the Gulf Coast, landowners can now demand and get as much as one-quarter to three-eighths royalty if there are enough land men bidding on their property.

The industry is beginning to realize that it truly cannot afford these high payments. Landmen are relying more on the true potential worth of land based on geologic study. Further, they are recommending that their companies drop the apparently worthless "protection" acreage in remote areas not likely to see immediate exploration.

Information exchange. Three institutions of fairly recent vintage are an outgrowth of the demand for economy in exploration. They are: the commercial scout check, the geophyical exchange center, and the well-log exchange center. Companies are learning to share the well dope, the seismogram, and the log. Secrecy is no longer the potent factor of riches that it used to be. As a result, these exchanges of information have been set up on a cooperative basis, and the saving in money and manpower has been enormous.

In reconnaissance exploration of new virgin country such as Alaska and northern Canada, large savings have resulted from the use of aerial surveys. Increased employment of airborne geophysical instruments and the growth of photogeology as a reconnaissance tool have cut weeks, and even months off exploration projects.

For example, surface geologists can now map in one 3-month season, prospects and concessions that would have required 5 to 10 years with old mapping techniques. Helicopters enable geologists to devote as much as 85% of their field time to actual mapping. In the past it was customary to spend 85% in travel and 15% in mapping.

Wider spacing. A great and growing aspect of more economical exploration and development is the acceptance of wider spacing. It is granted that the proper well spacing must be determined for each reservoir individually. One cannot overgeneralize in this respect.

By the same token, wider spacing during the initial development stages of a new field is highly recommended. Operators can always drill on closer spacing if it proves practical. Today, reservoir studies prove that thousands of unnecessary wells were drilled in the first 90 years of our oil industry.

The mad scramble that took place in East Texas field is a good example of wasted money. Today East Texas operators are considering the prospect of shutting in seven out of eight wells and producing the eight-well allowable from one.

Token progress has been made in such areas as Texas and Kansas. In Louisiana, there has been a real step forward; the Conservation Commission now assigns allowable on the basis of 50% credit for acreage up to 80 acres.

In the Rocky Mountains, the wide spacers have triumphed at Aneth field. While all don't agree that 80 acres is proper for this particular field, it is encouraging that Utah recognizes that good spacing is an economic necessity.

It appears likely that there'll be more emphasis on wider spacing as times goes on. Perhaps more oil men and state governments will see the wisdom

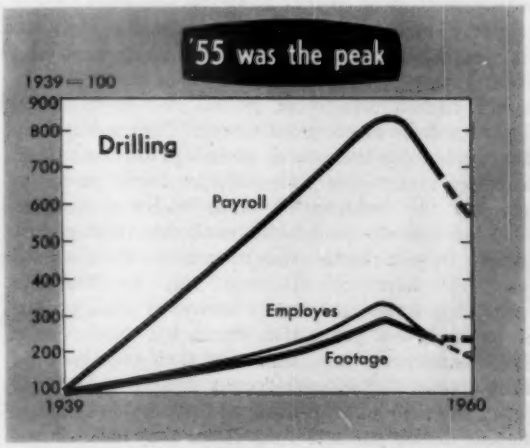


Fig. 5.

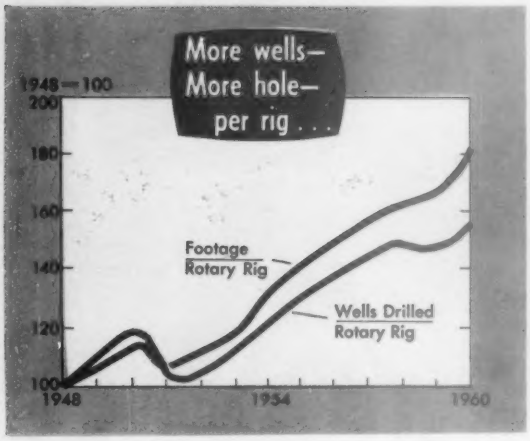


Fig. 6.

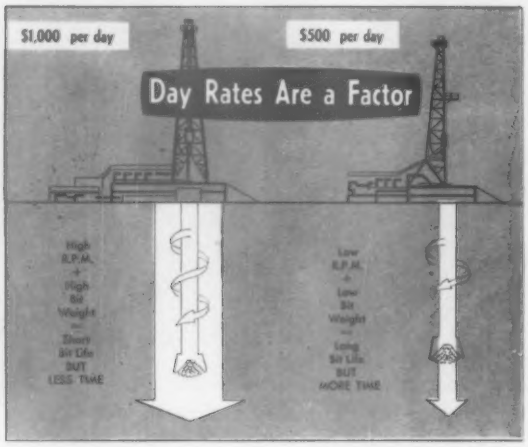


Fig. 7.

displayed by North Dakota where 160-acre spacing has been customary. Up there, they claim to have proof that wide spacing has encouraged more wildcatting.

Hand in glove with wider spacing goes unitization. Again, the case for unitized operation rests on the conditions existing in each individual reservoir. In general however, the merits of unit operation in primary or secondary recovery cannot be refuted in most fields. The great need is one of education for royalty owners, state regulatory bodies, and oil men, if you will. The spirit of free enterprise is strong in the oil business. But when more oil men realize that conservation through joint effort is both patriotic and profitable, unitization will spread as it deserves to spread.

Cost Cutting in Drilling

The drilling industry is buzzing with new cost-cutting ideas. There's good reason for this. Since 1955, drilling activity has slumped dismally (Fig. 5). As a result, contractors who now do practically all the drilling are locked in a fierce competitive struggle for survival. Since 1957 nearly one-fourth of these contractors have left the field. Those remaining in business reported last month in the Journal's annual survey, that close to half their rigs are idle.

Here and in geophysical exploration are the sharpest backlash of this period of adjustment to a lower rate of climb. But because of the relatively higher capital investment in the drilling business, the reaction is much more severe. Contractors may disappear from the scene; their rigs do not. Rigs reappear under new ownership at lower prices to intensify the bidding for what business remains.

This has sharpened the need for further cost cutting, despite the fact that contractors have a good record of increased efficiency, Fig. 6. Over the years they have consistently improved their record of wells drilled per active rig in the field. Since 1948, contractors have improved their efficiency by nearly 60%, despite ever-deeper drilling

A better index of drilling contractors' progress is footage drilled per active rig. Here they have shown an 80% improvement.

Some observers have said that the conventional rig has just about reached its ultimate in drilling efficiency. This is not true. A number of new concepts have arisen recently which indicate that much further room for improvement still remains.

Optimum drilling. The greatest expectations today arise from a new scientific approach to what is called optimum drilling, or minimum cost drilling. This involves no new equipment, but the better use of what the contractor has at hand.

The new approach results from basic studies which have developed mathematical expressions for the drilling rate of rock bits and their tooth and bearing wear rates in terms of rock properties, weight, rotary speed, degree of dullness, and mud properties. The method determines the best weight and rotary speed at every instant during the life of a rock bit, to give an optimum drilling rate. And "optimum" means the lowest cost per foot drilled, in terms of bit costs, day rates, and all other cost variables.

The calculus involved in weighing all of these factors must then be applied correctly to each rig on each well. Day rates are important factors, as shown in Fig. 7. With a big rig costing $1,000 a day, the cost of bits is relatively minor, so penetration rate is stressed at the expense of bit life. The reverse is true of the smaller $500 per day rig. The total cost is lower when fewer bits are used and drilling time is extended.

While this approach to optimum drilling has evolved gradually, it has now reached the point where drilling may be computer programed before a well is spudded. The best sequence of bit weight and speed is set from beginning to end.

Results have been spectacular. One company reports that in no case has this new approach failed to reduce drilling cost by less than 12½%. The average reduction to date has been around 20% and in one field, drilling cost was cut by a spectacular two-thirds.

In another program employing the same approach, an average cost reduction of 15-17% is projected.

However, the program is no substitute for good drilling practices. This approach is predicated on the best mud program and the best hydraulics available. The results noted here were obtained with rigs equipped with plenty of pump horsepower.

Multiple completions. Another approach to cost cutting is the use of multiple completions. In selected fields, this concept is saving millions of dollars in making one hole serve for two or more.

There have been new developments which make multiple completions easier and safer than ever before. It is now possible to run as many as three parallel strings of tubing simultaneously. This means that all packers and all tubing strings can be run into the well in the same operation; there's no need to strap strings together and there's no need to stab tubing into packers once they are in the well.

An example of this technique is the world's first quintuple completion made by Sinclair this past spring. Into its well, Sinclair ran five strings containing 33,000 ft. of tubing and six packers. All this equipment was made up on the derrick floor and run into the well in the same relation it occupies down in the hole.

Another important development has been the multiple completion where parallel strings of 2½-in. tubing are cemented side by side in the open hole. In this type completion there are no packers, no crossover subs, and no other complicated and expensive equipment. There are just two or more separate wells in one hole in the ground.

An example of this multiple completion with no single large casing is Sunray Mid-Continent's sextuple completion made in May. In this well, Sunray ran three strings of 2½-in. pipe and cemented them in the 8¾-in. open hole. Then, three strings of 1½-in. tubing were run to make a dual in each of the three 2½-in. strings.

Thus for 1960, the bulk of cost cutting has depended on a steadily rising rate of dual and triple jobs.

During the first 9 months of this year, 979 dual wells and 88 triples were completed in this country. The tempo of multiple completions has steadily risen in spite of the setback in Louisiana.

This practice with its obvious cost-cutting aspects is expected to continue apace.

Slim-hole drilling. This continues to be a factor in cost cutting, from the standpoint of the investment in casing and tubing. But it still costs about as much to drill a slim hole in most areas as to drill a regular hole.

Again, in some regions air drilling is faster than mud drilling, and progress continues on the problems of shutting off water in the hole. The fact that air drilling extends the life of bit bearings still recommends its use under certain conditions.

Neutralizing Crooked Hole

Drilling in crooked-hole country has always been slower and more costly because bit weights must be kept light to keep the hole straight. There are three reasons why the crooked-hole problem should begin to vanish:

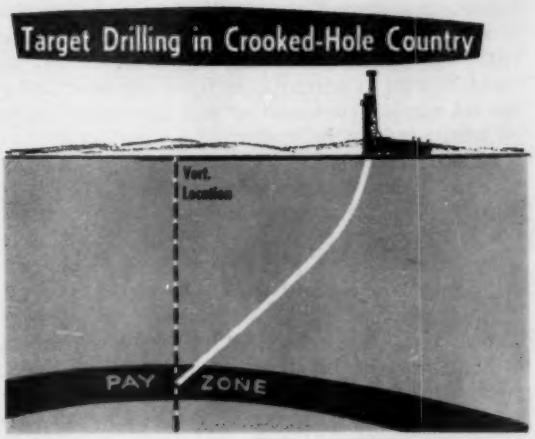


Fig. 8.

1. Acceptance of higher hole angles.
2. New tools to show hole angle while drilling.
3. Wider use of "target drilling."

Why is it that an oil company should be willing suddenly to begin permitting higher hole angles than the 3° or 5° it has used as standard in the past? For a good reason: the higher the hole angle permitted, the cheaper the hole is. Moreover, a high-angle hole can be drilled and produced with no more trouble than a low-angle hole.

As an example that high-angle holes are cheaper, look at the experience on a structure in the Four Corners area. It was taking 25 days to drill to 3,500 ft. while trying to keep hole angle to 5° or less. When deviation was allowed to 11° and above, the wells were drilled in as little as 14 days.

Pan American Petroleum Corp. has only recently released its findings from 3 years of research on crooked holes. Conclusion is that high hole angles, in themselves, do no harm; they find that dog-legs in the hole are responsible for most of the problems. Pan American says the dog-legs are just as likely in low-angle holes as in high-angle holes.

Target drilling is spotting the surface location to take advantage of the natural drift of the hole, Fig. 8. The bottom of the well winds up in the oil reservoir at the spot where it should, but drilling is not held up by attempts to keep a low-hole angle.

This idea has already been used quite successfully in a number of bad crooked-hole areas.

Lighter, Cheaper, More Portable Rigs

As rigs drill faster, they move more frequently. So, time spent in tearing down, moving, and rigging up assumes ever greater importance. There'll be progress in this important area, too.

As an example, drilling contractors have discovered it's much easier to plug in and unplug electric lines than it is to make and break chain connections. It is likely that an increasing number of new rigs will have electric drive.

And, this "electrification" won't be restricted to big rigs as in the past. The equipment is getting cheap enough to put on small rigs.

Another possibility is replacing conventional engines with light-weight, high-power gas turbines.

There are two good possibilities for immediate use of a gas turbine on the drilling rig. First would be in the Far North where waste heat from the turbine could be used to warm the rig floor and other areas. Second application would be in a lightweight rig to be transported by helicopter.

Electric wheels and gas turbines are just two of the more spectacular possibilities. There'll be others to lighten and cheapen the rig.

Fewer, Faster Round Trips

The drilling rig now loses a lot of time because it must frequently pull the entire drill string to change bits. If the bit could be kept on bottom drilling more of the time, costs would be lower. And, there are concrete steps in this direction.

First, consider the new sealed-bearing bit. By keeping grease sealed inside and mud sealed outside the bearing, the bit gets longest possible life. Result in many cases has been an increase in bit life of 50% or more. Sealed bearings are now put only in hard-formation bits, but should be on other types soon. With them, there will be fewer trips to make with the drill string.

But, even if only slow progress is made in decreasing the number of round trips, time can still be shortened by speeding up pipe handling in the derrick. One company proposes to speed things along by using a machine which will pull or run the string without human assistance. Such a machine is now being built and tested.

This much is certain: the automatic equipment is quite expensive. But remember that the major expense in operating a rig today is in labor. If two men in each crew could be replaced with a machine, roughly $50,000 per year in direct labor expense alone would be saved.

Turnkey Drilling Contracts

There will be a gradual shift to turnkey drilling contracts in many areas. Of course, there is only one incentive for such a switch: to save money. It appears likely that the opportunity to save money through turnkey contracts is improving almost daily.

A turnkey contract gives the drilling contractor a freer rein to plan the job and keep cost down. There's good reason for the contractor to have a freer rein: slowly but surely, the oil companies are losing the pool of men who are capable of intelligently supervising rig operations. The oil-company drilling department is becoming a thing of the past; there are no company rigs on which to train men.

As a result, no one else knows nearly so much about the drilling business as does the contractor himself. If he can't save money, no one can.

Another thing: inside the contracting business itself, the long-term trend is toward **fewer** and **larger** contracting companies. These big contractors have the financial stability to handle turnkey finances; a small contractor often has trouble arranging money for the slow-paying turnkey jobs.

Moreover, the large contractor can afford to have engineers and geologists on his own payroll to supervise the technical aspects of drilling and completing turnkey wells.

Other improvements. There remain many other improvements in equipment and techniques which the alert drilling contractor will put to good use.

A new modified lignosulfonate derived from the hemlock tree is a quadruple-threat mud-treating agent. A small amount of this additive thins mud, cuts water loss, and inhibits hydration and swelling of clays.

A new device designed to cut down time is the stuck-pipe vibrator.

A wall-anchored drill collar weighing 5% as much as conventional drill collars can apply the same weight to the bit hydraulically, using normal mud pressure.

Another new tool using low-energy gamma rays will pinpoint the entry of water, oil, or gas into a well bore. Still another new device which will aid drilling research by reliably measuring actual downhole conditions while drilling is in progress.

These plus a parade of further new developments are making their appearance every month. The drilling contractor, as probably no other member of the industry, needs to remain aware of how they might help him cut his costs.

Production Cost Cutting

How are producers progressing in cost cutting? Not as well as other divisions of the industry. From the standpoint of labor, a gradual reduction in number of employes has taken place during the past 20 years. But the rising rate of hourly wages has far offset this gradual reduction in personnel, Fig. 9.

More than any other industry division, production is the province of the small independent operator. On the small lease, the operator is limited in the measures he can take to reduce his costs to any great extent.

Proration further limits many producers in spending money to save money. Payouts are greatly extended and many producing properties simply do not justify the addition of new, more efficient equipment or methods at the present time.

However, the producer looking for ways to reduce well cost and labor cost will have these paths open to him:

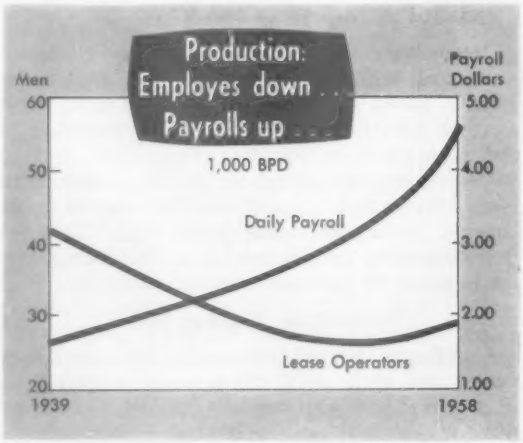
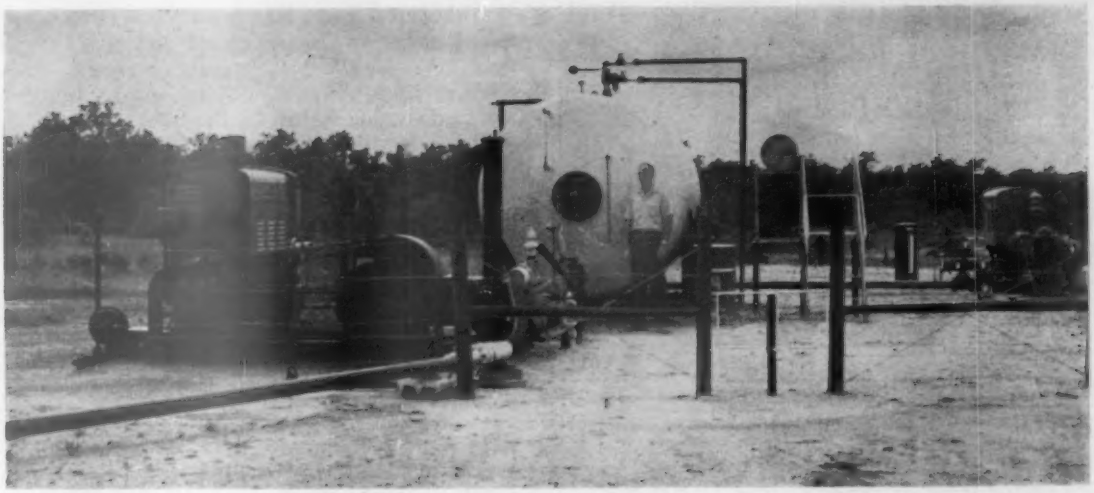


Fig. 9.



SKID-MOUNTED FLOOD UNITS are saving money on the smaller secondary-recovery projects. Fig. 10.

1. Recovering more oil by secondary means.
2. Installing more labor-saving automatic equipment.
3. Contracting out more lease work.

More Secondary Recovery

In the future we'll be seeing wider application of all secondary-recovery methods such as gas cycling, so-called miscible displacement, and water flooding. There have been some outstanding successes with miscible floods. Most have used slugs of butane and propane driven by either gas or water. Several others are using wet gas.

The recovery project at Bisti field in the Four Corners area is an LPG miscible-displacement project. At last report it was doing nicely.

Water flooding. Today, water flooding remains one of the best ways for an oil man to get new reserves. There's no finding cost, and new-well cost is low. According to our latest figures, nearly 900,000 bbl. per day comes from water-flood leases in this country.

There are 2,625 projects in 17 states, covering more than 1 million acres making use of 94,000 producing wells and more than 73,000 injection wells.

Water flooding can have greater application to smaller leases. The skid-mounted unit in Fig. 10, first tried in Oklahoma, is becoming popular throughout the oil country. Water injection means a faster payout in the field, and the portable water-flood units can be moved from location to location as needed.

Units like this are now available from several manufacturers at reasonable cost.

Fire flood. Many oil researchers are particularly enthusiastic about the "fire flood" or "insitu combustion." With almost 10 years of laboratory and field experiments now behind them, some of the scientists are now predicting that fire floods will become competive with water flooding in this decade. It can recover as much as 75% of oil in place, consuming the remaining 25% for a clean sweep of the reservoir. Fracturing is no barrier, despite some earlier reservations on that score.

Moreover, thermal recovery is now recognized as a usable tool for most producing formations, not only those containing heavy viscous crudes. It is now judged equally as effective as water flooding and miscible-phase displacement by some engineers. One company in fact has been buying old producing properties for several months with the aim of instituting fire floods in the future.

The same things that make secondary recovery attractive are going to make "tertiary recovery" a hot topic in the next several years. You'll probably be reading soon about field tests where either fire flooding or solvent flooding is being tried in a reservoir that has already been water-flooded out.

More Automatic Equipment

One of the oil producer's biggest expenses is labor. Thoughts usually turn to automatic equipment when labor saving is brought to mind. Automatic production equipment usually means that for pumping oil out to pipeline. That is, LACT equipment or lease automatic custody transfer.

The Journal has just completed a survey among producers and pipeline companies to get their reaction to LACT. Our conclusion is that there'll be a snowballing number of leases where oil is sold automatically. After you have one LACT unit, the next comes easier and cheaper. Finally, the company thinking is geared to the automatic equipment.

Costs are fairly high, but engineering and design are now well established, and volume production of components will in turn promote greater application.

Less than 10% of our domestic production is handled by these automatic units. The major companies are the principal users, with 20% to 25% of their own production now on LACT. One major company will have 30% of its production so metered by the end of this year.

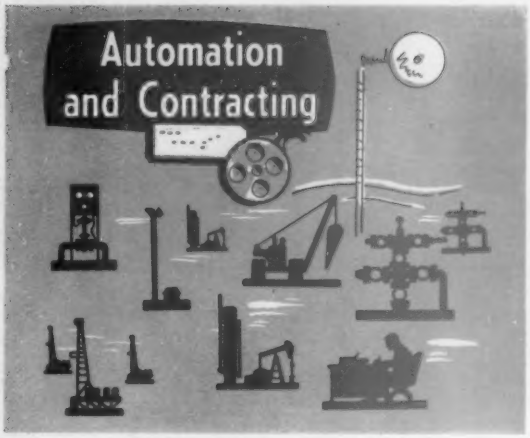


Fig. 11.

Those independents who have been waiting for off-the-shelf LACT units need wait no longer. This technique is now worth a second look, for leases as small as 200 bbl. per day.

But here arises a need for better communications between industry divisions. LACT benefits the pipeliner as well as the producer. Producers have carried the ball thus far. It is now up to pipeline companies to evaluate their interests in this progressive development, and to support it with equal participation. This move would make it possible for many smaller producers to take advantage of lowered lease costs, to the mutual benefit of both.

Other areas. Look for automation in other areas, too—such as well testing and processing paper work, Fig. 11. Where leases have enough wells, say 8 or 10 or more, it won't be hard to justify an automatic-testing system for the labor saving alone.

Look for run tickets and well-test reports to be punched into IBM cards or recorded on tapes. Then this information can be processed by machines much quicker than when done by hand.

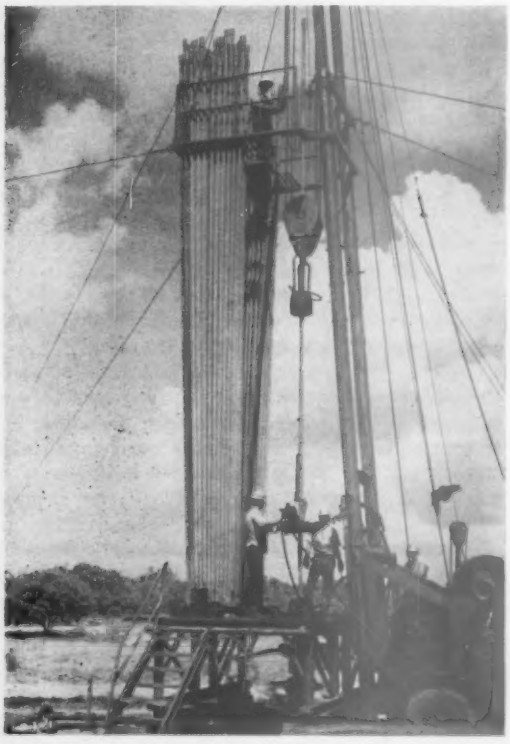
Contracting Lease Work

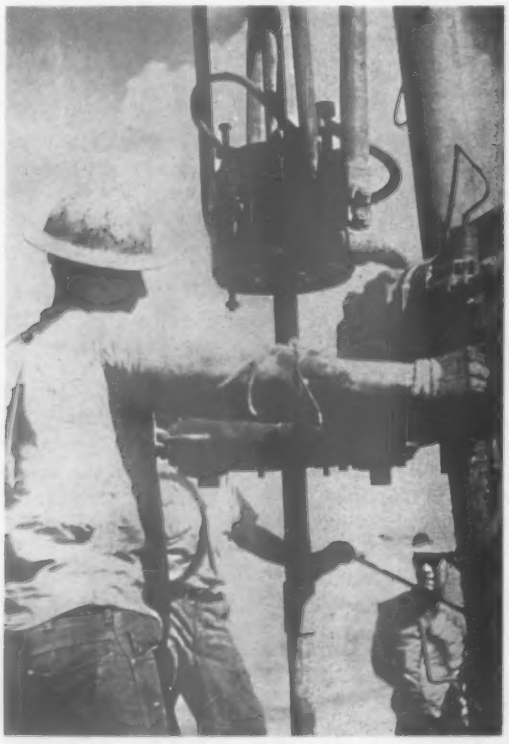
There's a trend today in all industries to contract out more work. And, that trend has carried over into the oil-producing business. Drilling and well servicing are largely carried out by contracting firms.

Now there is beginning a shift of lease pumping away from the oil company to contractors. And it appears that the move has only just begun. Many companies have already discovered that their overhead is so high that they can get leases pumped more cheaply if the job is contracted than if it is done by a company employe.

Look at Tennessee Gas & Oil Co.—the subsidiary producing company of Tennessee Gas Transmission Co. Here is an oil producer which has some 50,000 bbl. daily of oil production and yet does not have one single pumper on the company payroll. The company started out with its own pumpers but switched over to contract operation because there was an immediate money saving.

Other companies—and large ones—will be following this same course.





SPLIT TRAVELING BLOCK, which is easily installed on a well-servicing unit, has speeded up tubing jobs by 50%. Fig. 12.

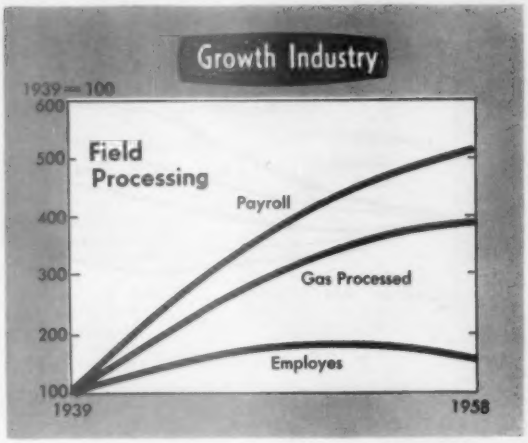


Fig. 13.

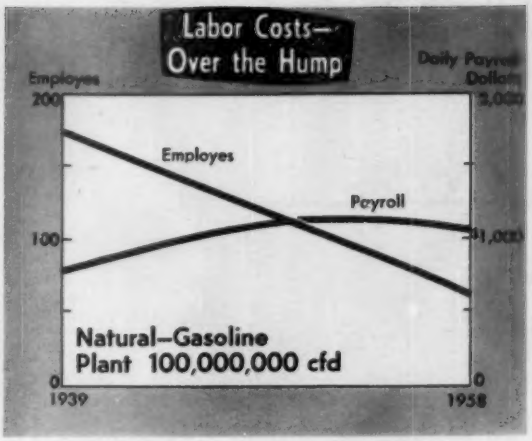


Fig. 14.

Mobile equipment. With newly designed mobile equipment, service companies now offer new economies to the major and independent alike.

One example of several ingenious devices they have adopted is the split traveling block (Fig. 12). Easily installed on a well-servicing unit, this new block has speeded up tubing jobs by 50%. A transfer hoist is used to handle tubing singles. This permits the U-shaped split traveling block to move continuously up and down without the time-wasting pause at the top to hold the string, or the pause at the bottom while a new joint is made up. The block rides up and down on the tubing string and spends its full time on its primary job pulling the string.

Reducing Field-Processing Costs

Field processing of natural gas is one of the bright spots in the present petroleum picture, Fig. 13. This division is still expanding at a rapid rate, primarily because of the heavy demand for natural gas in new major market areas.

At the same time, field processors have instituted a number of important cost-cutting techniques. The principal factor in reducing over-all costs in field processing has been automation. Today 100-million-cubic feet plants are running with one operator and one helper per shift. This compares with an average of four to five operating men per shift in nonautomated plants.

Automation in field processing runs the full gamut of new instruments and controls. However, the new electronic instruments have yet to be fully utilized. Some are finding application in temperature transmission, but most field processors must await the day when simpler, more reliable instruments are on the market. They cannot justify the maintenance personnel because their plants are smaller in size than for example, most refineries.

New tools for rapid, continuous analysis are also finding application in large natural-gasoline plants. These instruments do not contribute directly to cost cutting, by way of personnel, but they do raise the efficiency of those plants by keeping them more closely on optimum operations.

Number of employes. This has actually declined in recent years, despite the steady upward trend in gas processed, Fig. 14. In this chart showing the relationship of employes and payroll for a typical 100-million-cubic-feet plant, the results of automation are evident in the actual decline in major costs by 1958.

Other factors bear on cost cutting in field processing. The trend today is toward very large plants, some of which serve two or more fields. In other cases, giant plants are being located on large gas-transmission lines.

On the other hand, there has been a remarkable growth of very small, skid-mounted gas-processing units. These units are obviously less efficient, but they do bear on economics in that they now process gas formerly flared or used in the field. These short-cycle, dry-bed plants contribute to greater profits by recovering enough liquids to pay for dehydration costs. In this sense, they extend the economic processing of gas in the field and are therefore true factors in cost cutting.

Another trend which has promoted better returns is the greater recovery of propane from natural gas. Many existing plants have added refrigeration to supplement their income with greater propane production. At the same time, these plants were often automated, adding further to their profit picture.

Satellite system. Another concept in cost cutting is the satellite system for handling casing-head gas, Fig. 15. Lean oil from the centrally located plant is circulated to satellite absorbers throughout the field. The rich oil is returned to the central plant for stripping and fractionation of light products. This system reduces total horsepower requirements for fluid handling since some gas is usually reinjected in the field. Capital-equipment cost is lowered, too.

Lowering Pipelining Costs

The pipeline industry has been one of the leaders in embracing cost cutting methods This is evident from the trends of the past 7 years, Fig. 16. Billions of dollars have been spent in new equipment to

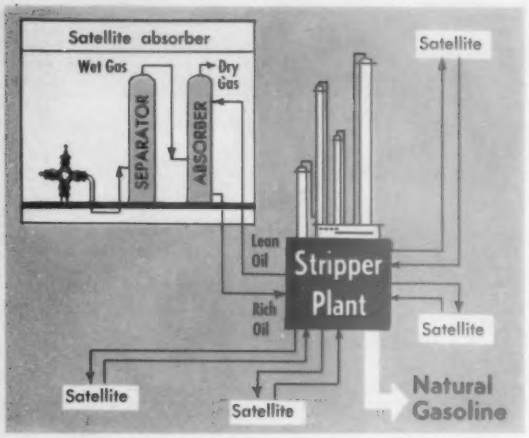


Fig. 15.

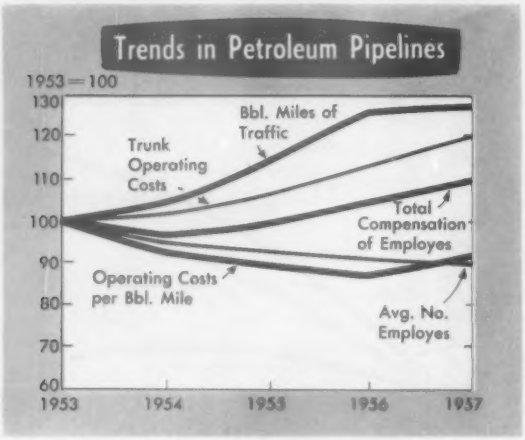


Fig. 16.

give greater economy in oil and gas transportation. Pipeliners have gone to larger diameters, and have led the petroleum industry in their application of remote control. The result has been a steady reduction in operating costs per barrel mile.

However, 1957 represented an unusual year. The rise in operating costs was brought about by the aftermath of the Suez crisis. There was a rapid drop in total traffic during which period costs caught up with over-all operations.

Regardless of the efforts expended in cutting costs of operation, pipeliners have long recognized that their greatest advantage in cost cutting lay in controlling capital expenditures. This is particularly true in an industry division with such a strong growth record. As one pipeline executive said recently, "I can wear myself out working to automate my system, increase efficiency, and reduce labor costs and fuel consumption, without making a noticeable dent in the cost of service. But let me find a way to cut capital costs of pipe or major machinery—then I've got something."

When pipeliners talk about capital costs, they are referring primarily to pipe. Pipe in the ground represents from 70% to 90% of the total cost of a pipeline system. The cost of pipe has doubled since 1950. As a result, any economics that can be brought about in pipe investment will affect industry economics to a large extent.

Stronger pipe. One of the most promising areas in cost cutting lies in the higher-strength pipe which is now being put into use. X-56 pipe with a 56,000-psi. yield strength has found eager acceptance. Steel companies now feel that they can deliver 60,000 to 65,000-psi. yield-strength material in the near future. Some predict pipe in the 80,000 to 90,000-psi. range, with good weldability, within the next few years.

These new steel alloys are expected to loom most important in cutting capital costs in the foreseeable future. Pipeline companies are planning to use the largest diameter, thinnest wall possible in future projects.

In the field of prime movers, pipeliners are also finding new ways to greater economy. The gas turbine has entered the field, and standard compressor units are now available with increased power, efficiency, and automation. New design for compressor stations is contributing further to reduced costs.

In existing pipelines, the application of remote control is permitting new economies by maintaining flow at optimum levels of efficiency.

But pipeliners are still not satisfied. Here are some of the things they want in the future:

- Pipe, coated both internally and externally, in the mill.
- Higher-strength, thinner-wall pipe.
- New competitive substitutes for steel.
- Automatic welding for the pipeline right-of-way.

No major competition for steel is in the offing. However, companies are investigating the use of a large diameter, flexible hose for river crossings. Others are testing plastic pipe for use in low-pressure gathering systems as well as distribution systems. A new plastic with a working pressure of 150 psi. is expected to be announced this year.

Cutting Refining Costs

The division of refining has long held the position of a poor cousin in the industry family. Squeezed

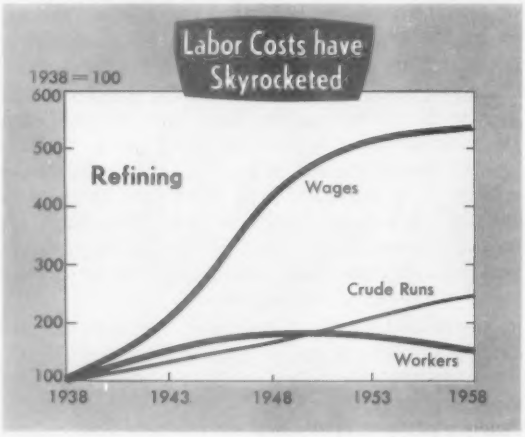


Fig. 17.

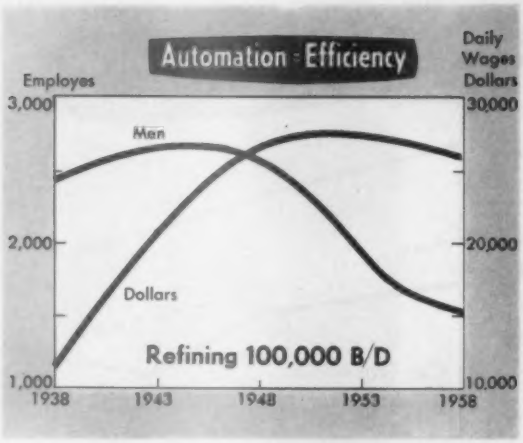


Fig. 18.

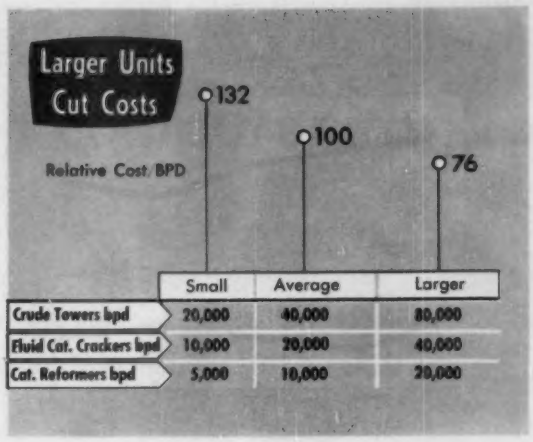


Fig. 19.

by low product prices and mounting costs, the refiner was acutely aware of the need for cost cutting long before the industry entered this difficult adjustment period.

With labor costs rising steadily, the refiner has taken the only recourse possible—a gradual reduction of payrolls, Fig. 17. This has been accomplished largely by attrition—as their older men retired, refiners have not hired full replacements. In many cases construction forces have been retired. Contractors now handle nearly all such work, ranging from major new projects to small revamp jobs.

Contract maintenance has contributed further to labor economies. In the larger refining centers, contractors handle turnarounds for a number of plants, scheduling their work to maintain a steady work load the year around. Some refiners now farm out even routine maintenance. A new aspect of this is the instrument maintenance firm which relieves the refiner of keeping high-salaried employes on a standby basis.

As a result, total employment in refineries began a downward trend in 1949, even though capacity and runs continued upward.

Upgrading labor. But the trend in upgrading labor productivity began even earlier. As early as 1944 employment of shift labor began to drop with relation to crude runs, Fig. 18. Individual wages have continued upward, but by the early '50s the reduction of forces brought a slight downward trend in total payrolls for a given level of refining activity.

Much of the credit for this important cost-cutting move must go to automation. The varied application of instruments, controls, and new testing and analytical tools has wrought a revolution in refining.

The end of this progress is not yet in sight. Today, the potential use of electronic computers promises staggering results in higher plant efficiency. Computer controls may not further reduce the refiner's payroll to any great extent. But they do promise to cut costs by maintaining processing units consistently at those conditions which integrate to the greatest yield of products showing maximum returns.

Computer programing goes even further. It is now possible to select from the thousands of variables in operating conditions, crude types, and market returns, that combination which gives optimum returns. Optimizing by computers holds the brightest prospect of any approach to refining profits in the future.

Costs high. Capital costs are high in refining. The ratio of capital investment to manpower is one of the highest in industry. And refiners are closely studying the possibility of the savings which accrue in large single processing units, Fig. 19.

The relationship in capital costs per daily barrel of capacity is evident. In recent years, new expansion projects have definitely trended toward larger units.

But with an excess of 1½ million barrels per day in refining capacity, there is little call for expansion today. Even so, the economies of large units are such that some refiners are now substituting single large units for several smaller ones without adding appreciably to over-all capacity. This is particularly true in the case of crude units.

Maintenance costs. With labor costs approaching

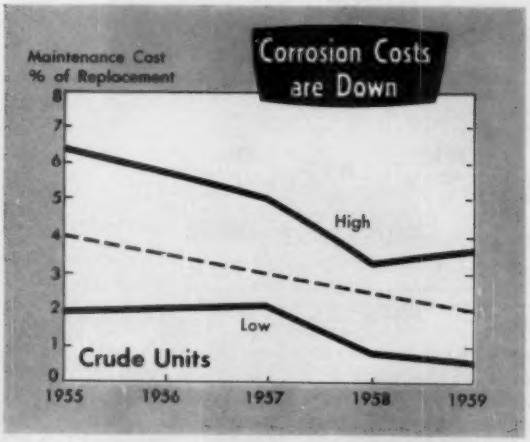


Fig. 20.

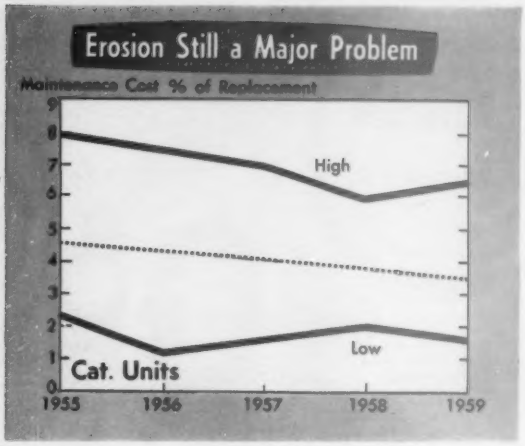


Fig. 21.

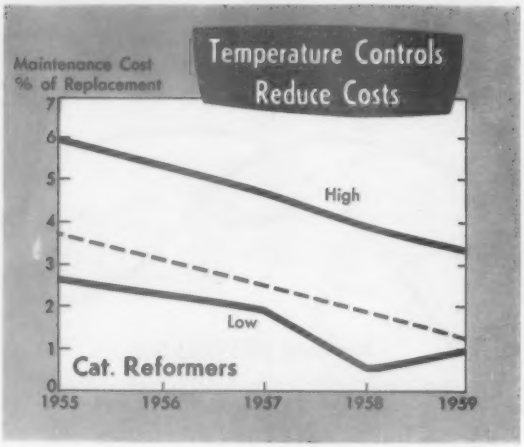


Fig. 22.

close to minimum and with no immediate prospect of savings through addition of more efficient capacity, refiners are turning to maintenance, the one remaining area that promises major cost reduction.

The selected trends in maintenance costs shown in Fig. 20 illustrate the opportunities. Corrosion takes a heavy toll in all process operations. Improved desalting and the use of more resistant materials and better inspection devices are showing results in most refineries. Onstream and offstream chemical cleaning has made important strides in cutting unit down time.

In catalytic cracking devices, catalyst erosion remains a problem, Fig. 21. New abrasion-resistant lining materials are needed. Improved inspection devices are aiding in detecting trouble before it happens.

In catalytic reformers, better temperature controls are extending the intervals between turnarounds, Fig. 22. In this respect, improved maintenance has a most important bearing on cost cutting—outweighing any economies in labor costs. The costs of shutting a unit down, inspecting, repairing it, and bringing it back on stream are enormous in terms of lost production alone. The gradual extension of operating periods between turnarounds has accounted for very important savings in refineries across the country.

Public and Government Relations

Oil's principal product—gasoline—carries the highest sales tax of any commodity on the market—three times the rate paid on diamonds and mink coats, for example.

Fully one-third of the price of gasoline at the pump is tax, as shown in Fig. 23. The point needs no further laboring.

The petroleum industry, through its aggressive character and its success in meeting extraordinary demands over the past, has unhappily become a symbol of extraordinary prosperity. However, in terms of its huge investments, it ranks well below most other industries, Fig. 24.

It is a reasonably prosperous business which has its ups and downs like every other. But the general public, and its lawmaking representatives, apparently don't share this view.

Admittedly, the industry has encouraged land owners to expect generous leasing and royalty payments. It has become the major vehicle for the tax gatherer. It now finds even the sound, historic concept of percentage depletion in jeopardy.

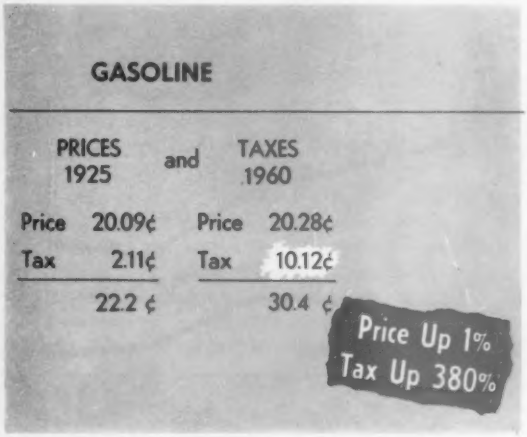


Fig. 23.

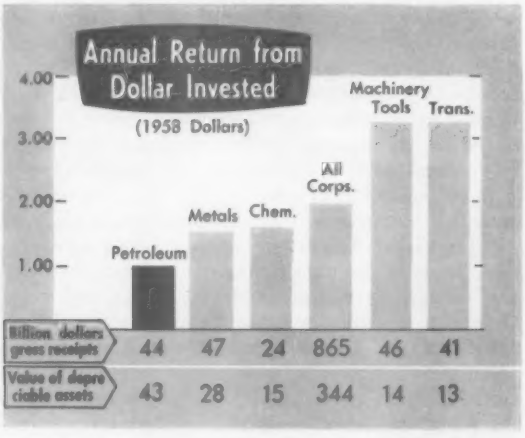
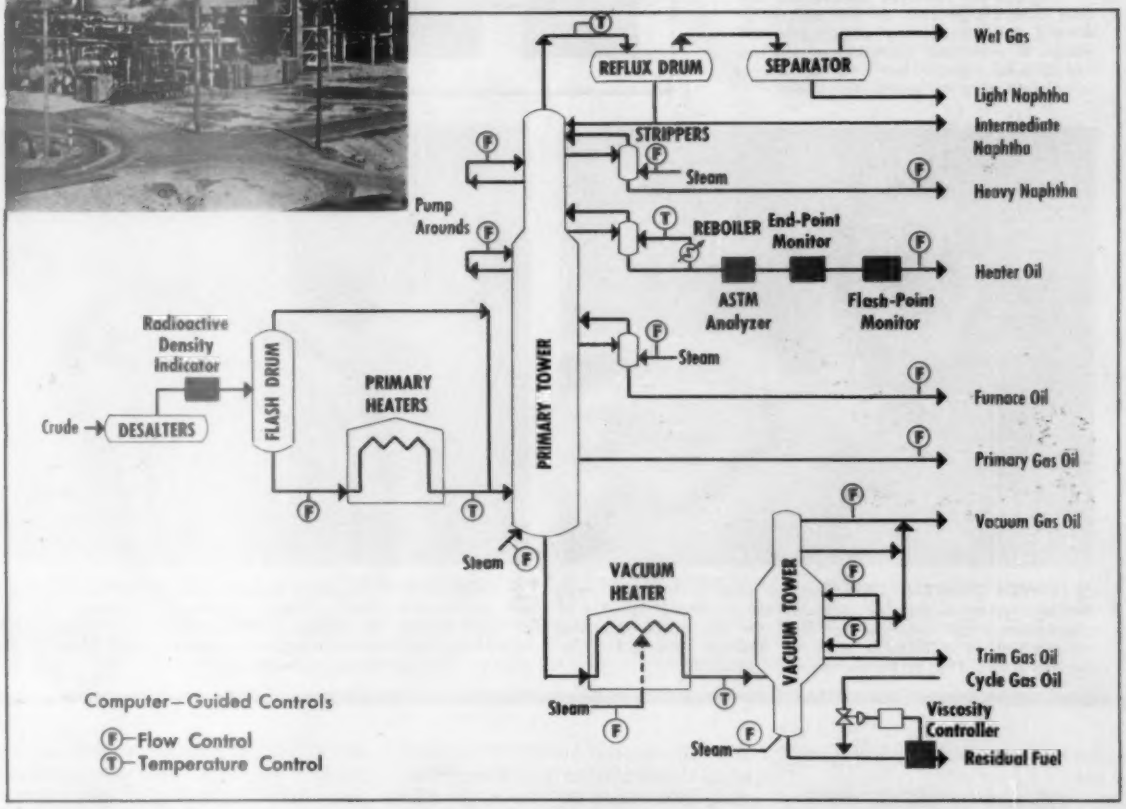


Fig. 24.

World's biggest crude unit nears computer control

Big 140,000-bbl. unit is on computer open-loop control. By year end the development program should be complete and unit optimized, thus enabling Standard engineers to close the loop.



CRUDE-UNIT CONTROL by computer is based on 19 guided flow and temperature controls. Five process-monitoring instruments provide vital information for the computer program. Fig. 1.

AN ELECTRONIC COMPUTER is optimizing operations on the No. 12 pipe still at the Whiting, Ind., refinery of Standard Oil Co. (Ind.).

Every 4 minutes an IBM 704 computer reads 196 instruments. Every 20 minutes, it types out orders that originate from 75,000 stored instructions. These orders guide operations so that the unit operates at peak efficiency.

Signals from the instruments are transmitted 1 mile over a pair of

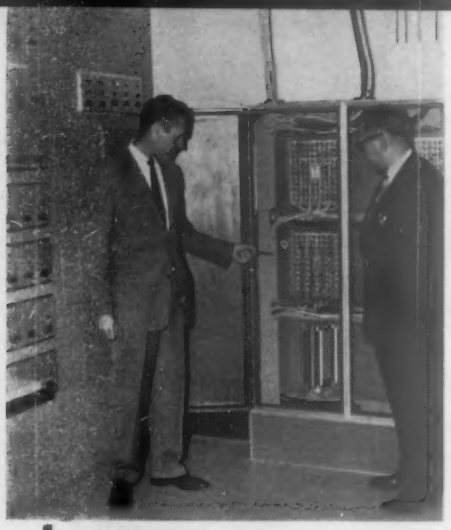
BY G. L. FARRAR
Engineering Editor

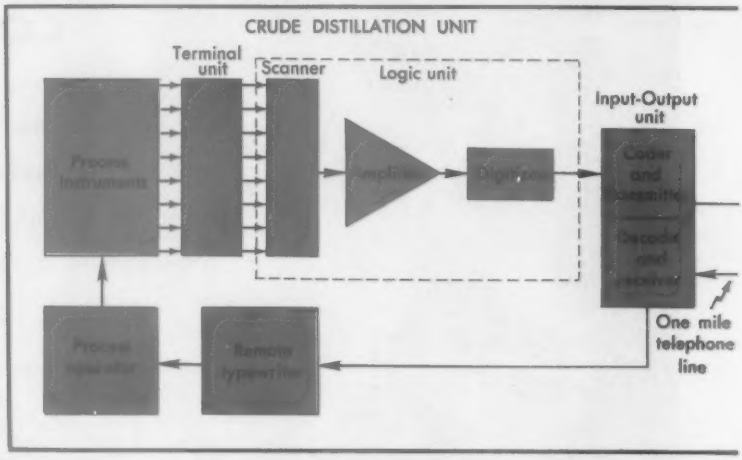
telephone lines to the computer housed in the refinery administration building. The computations are sent back to the control room and printed out by an automatic typewriter. Results are used in adjusting 19 controllers as needed.

Much closer control of the unit is possible as the result of this program. Manual calculation of the data is possible, but the needed information could not be obtained in time to be used in real-time control. The computer spends up to 8 hours per day on the control assignment. Then 8 or more hours are spent on other scientific calculations.

Closed loop coming. Full closed-loop control is expected early next year. This will come when the development program is complete and the crude unit is running as close to optimum as possible. Standard engi-

How computer control





1 TERMINAL UNIT of process-monitoring system receives instrument signals from crude unit. At left are transducers for converting pneumatic impulses to electrical impulses which are coded and transmitted over mile-long telephone line to computer room.

2 PUNCH CONTROL UNIT can be used to initiate scans by either button or interval timer. There is also a scan button on input-output unit. Or computer may be programed to initiate a scan at desired time intervals. System scans 196 instruments in 77 seconds.

3 COMPUTER is used for process control on an interrupt basis. It has a "real-time package" and can receive or send digital information in electrical form. If computer is tied up on other calculations, punched cards store information until computer is ready for it.

neers expect to reach this point early in 1961.

The approach to closing the loop will be the designing of a computer for on-site, on-line control. When the control development program is complete, IBM and Standard engineers will know just what is necessary to do the job. And IBM expects to be able to put the computer together using components already available.

Economics. Standard of Indiana fully expects a satisfactory economic return from computer control of the No. 12 pipe still because it is felt operation has been improved measurably. And considerable savings accrue with small improvements on a unit with such large throughput.

The crude unit will be run with and without the computer to determine differences in operation. When these differences are known accurately, savings can be calculated. This on-off procedure will also help determine how often to scan and make optimization calculations.

The Standard management is also looking beyond the crude-unit control project toward the long-range impact of this development on refinery operations broadly, as well as to immediate savings and attractive payout.

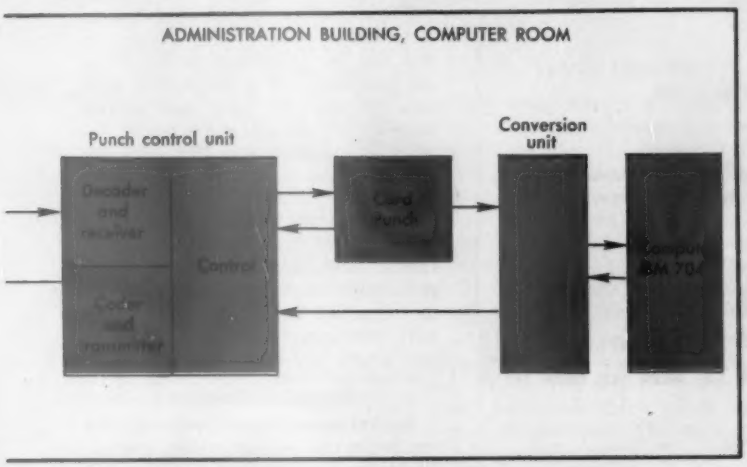
Joint study. The computer-control project began as a joint study between Standard and International Business Machines Corp. over 2 years ago. Early work involved a smaller crude unit and an IBM 650 computer. Results from that study led to the present full-scale program which began about 1 year ago. This program has been fully staffed for only 10½ months.

The joint study has required close cooperation among many mathematicians, computer specialists, chemical engineers, and control engineers for the two companies.

Development of the mathematical model for the process is a great achievement in process engineering. There are 500 equations in the model, and these should enable Standard Oil to go from average good control to outstanding control.

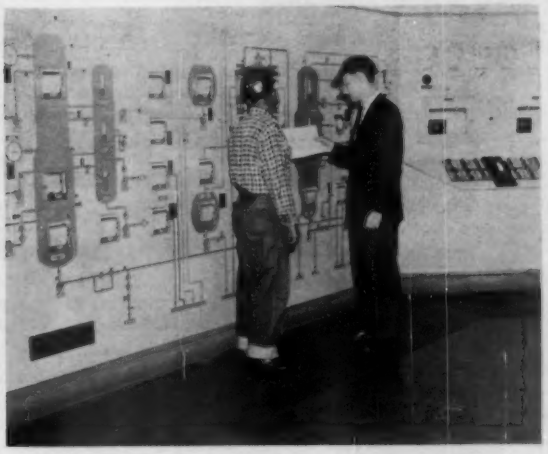
The optimization and control techniques also represent outstanding achievements in mathematical and computation procedures.

works for Standard



5 **CONTROL INSTRUCTIONS** from the computer are printed out on automatic typewriter in the process-unit control house. Sample sheet is shown in Fig. 3. These instructions tell how process instruments should be reset to optimize operation of crude unit.

4 **COMPUTER PRINTER** can print out 150 lines of detailed process information per minute. These calculation results are much more complete than the information sent to the operator for process control. Engineers use the information to study the unit.



6 **PRINTER SHEET** from the automatic typewriter is taken to the schematic control panel of the crude unit where required instrument adjustments are made. Computer optimizing permits multicontroller adjustments. During conventional control one controller at a time is adjusted.

The program of 75,000 instructions is more elaborate than that finally needed for computer control of the distillation unit, since provision is made for the research program which is a part of the control study. Alternate mathematical and statistical techniques are being explored, so that best possible combination can be incorporated into the final control scheme.

Standard engineers don't know yet just how many instructions will be needed when the research program is over, but they estimate that perhaps one-fourth to one-half as many will be required. Thus, a computer with a large memory will be necessary.

Other installations of computer control are already being considered by the company. Next candidate is an ultraforming unit. Catalytic cracking and alkyaltion are also likely prospects, and plans for the necessary programs are being studied.

Instrumentation Development

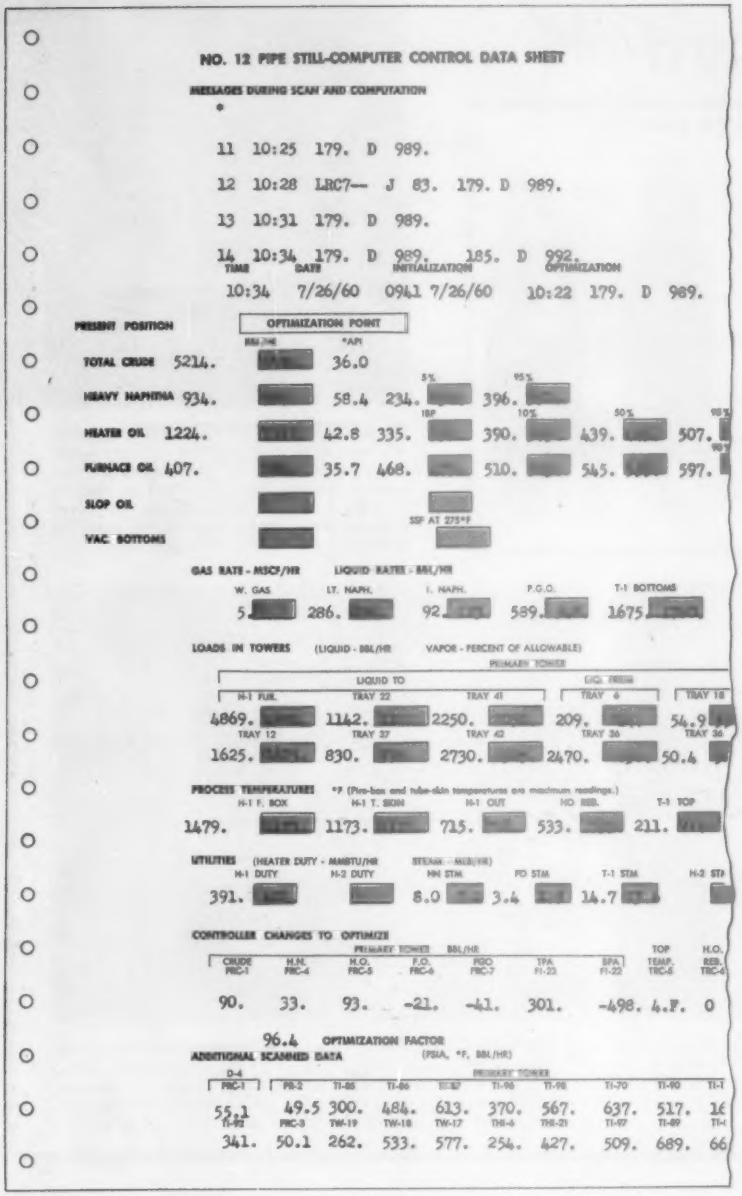
A flow diagram for the No. 12 pipe still is shown in Fig. 1. Some 90,000 bbl. per day is removed as overhead and sidestream products in the primary tower of this unit. The remaining 50,000 bbl. per day is removed as bottoms and fed to the vacuum tower.

Products from the vacuum tower include vacuum gas oil, trim gas oil, and vacuum bottoms. The bottoms stream is blended with cycle gas oil from cat cracking to give a residual fuel of about 150 S.U.s viscosity at 210° F.

Initial operation good. When the crude unit began operation in 1959, advanced instrumentation techniques, developed in studies on a smaller crude still, were employed. Operators were able to maintain stable operation and make specification products at reasonable throughputs.

However, there was no assurance that the plant was running at highest yields of the more valuable products, or that fuel was being used most efficiently. Too, conventional instruments could control only one variable according to a relatively simple objective.

Earlier studies. The way was pointed to better control of the unit


NO. 12 PIPE STILL-COMPUTER CONTROL DATA SHEET
MESSAGES DURING SCAN AND COMPUTATION
11 10:25 179. D 989.
12 10:28 LRC7— J 83. 179. D 989.
13 10:31 179. D 989.
14 10:34 179. D 989. 185. D 992.
TIME DATE INITIALIZATION OPTIMIZATION
10:34 7/26/60 0941 7/26/60 10:22 179. D 989.
PRESENT POSITION
OPTIMIZATION POINT
BBL/HR °API
TOTAL CRUDE 5214. 36.0
HEAVY NAPHTHA 934. 58.4 234. 396.
HEATER OIL 1224. 42.8 335. 390. 439. 507.
FURNACE OIL 407. 35.7 468. 510. 545. 597.
SLOP OIL
VAC. BOTTOMS
SSP AT 275°F
GAS RATE - MSCF/HR LIQUID RATES - BBL/HR
W. GAS LT. NAPH. I. NAPH. P.G.O. T-1 BOTTOMS
5 286. 92. 589. 1675.
LOADS IN TOWERS (LIQUID - BBL/HR VAPOR - PERCENT OF ALLOWABLE)
PRIMARY TOWER
LIQUID TO
H-1 FUR. TRAY 22 TRAY 41 DIG. FROM TRAY 6 TRAY 18
4869. 1142. 2250. 209. 54.9
TRAY 12 TRAY 27 TRAY 42 TRAY 36 TRAY 36
1625. 830. 2730. 2470. 50.4
PROCESS TEMPERATURES °F (Fire-box and tube-skin temperatures are maximum readings.)
H-1 F. BOX H-1 T. SKIN H-1 OUT H-2 RIB. T-1 TOP
1479. 1173. 715. 533. 211.
UTILITIES (HEATER DUTY - MMBTU/HR STEAM - MLB/HR)
H-1 DUTY H-2 DUTY MH STM FD STM T-1 STM H-2 STM
391. 8.0 3.4 14.7
CONTROLLER CHANGES TO OPTIMIZE
PRIMARY TOWER BBL/HR
CRUDE H.N. H.O. F.O. PGO TPA BPA TOP TEMP. H.O. REB.
FRC-1 FRC-4 FRC-5 FRC-6 FRC-7 FI-23 FI-22 TRC-5 TRC-6
90. 33. 93. -21. -41. 301. -498. 4.F. 0
96.4 OPTIMIZATION FACTOR
ADDITIONAL SCANNED DATA (PSIA, °F, BBL/HR)
PRIMARY TOWER
D-4 PRC-1 P5-2 TI-85 TI-86 TI-87 TI-96 TI-98 TI-70 TI-90 TI-1
55.1 49.5 300. 484. 613. 370. 567. 637. 517.
FI-95 PRC-3 TW-19 TW-18 TW-17 TW-6 TW-21 TI-97 TI-89 TI-4
341. 50.1 262. 533. 577. 254. 427. 509. 689. 66

COMPUTER OPTIMIZATION, along with actual values of process variables, is printed out by the automatic typewriter on this form. Fig. 2.

by earlier joint Standard Oil-IBM studies on a 60,000-bbl. crude unit at Whiting. About 100 temperature, pressure, and flow readings were telephoned to the computer center and punched into cards. The information was then processed on an IBM 650 computer to yield heat loads on furnaces, tray-by-tray vapor and liquid loadings, and accurate yield of products.

Accuracy of the calculation was enhanced by adjusting measurements to satisfy several heat and material balances around overlapping circuits.

This called for statistical routines. Simultaneous solution by least-squares technique was used to achieve the best possible balance.

Factors were also introduced which evaluated individual meter reliability. These took into consideration whether calibration against tankage had been possible, and actual pen position on a square-root chart.

The output information guided engineers in their search for more knowledge about the process. By comparing current results and recent trends against the constraints of the unit, they could apply judgment and determine how control settings should be changed.

The computed diagnosis enabled operators to make adjustments to transfer line temperatures, crude-oil rate, or primary tower pressure which they otherwise would not have made.

But still other control opportunities were clearly missed. One reason for this was the reluctance to decide on changes based on a single indication and the relatively long time interval between two successive diagnoses. Another shortcoming was that manually collected data were not entirely error free.

Based on the control requirements of the larger crude unit and on the results from computer diagnosis of the smaller crude unit, it was decided to continue the development on a fully automated basis on the larger unit where payoffs would be greater.

Operating Variables

Several types of operating variables are important in automatic control. These include primary, constrained, and economic variables.

Primary, or independent variables, can either be controlled or uncontrolled. Those which can be controlled are manipulated by plant operators. While there are nearly 100 of these on the crude unit, only 19 are considered important for hour-to-hour control of the unit. These are the 15 flows and 4 temperatures shown in Fig. 1.

The uncontrolled variables included several aspects of crude quality and ambient conditions. To a large extent, their fluctuation justifies computer control.

Constrained variables limit the mode of operation of the process, in addition to the obvious limits of the 19 controllers. They can be either equipment constraints—reflecting the unit's physical limitations — or production constraints which are management-imposed targets set at short intervals. These may be expressed in terms of crude-oil feed rates or quantity or quality of material to be produced. Altogether there are about 160 constrained variables of which 54 are important for hour-by-hour control.

Economic variables are important to optimization and include such things as incremental prices and costs, actual product quantities and consumption of raw materials and utilities.

Control Concept

The control concept includes two broad phases. The first seeks an accurate diagnosis of current operating conditions of the plant. The second involves optimization which leads to recommended adjustments to controller set points.

The diagnosis is developed as the computer automatically scans instru-

ment readings from the 196 different instruments Data may also be added manually based upon laboratory inspections.

In the optimization function, values of constrained variables are compared with actual constraints. An approximate profit equation is also introduced, along with any other additional constraints imposed by management.

Management constraints. These have to do with markets and sales, and operability of various parts of the crude unit and other refinery units. For example, a certain quantity of heater oil can be sold at a good price. A management decision to make at least this quantity is put into the computer program. Management decisions fall into three broad categories:

1. The value of each product. Price tags are placed on each one, and the computer can then determine the proportionate split of a component which can go into two products.

2. Limits to production. A decision of this nature might be that the unit is to run a minimum of 135,000 bbl. of crude daily, plus whatever else can be run economically. Or, it may be decided that production of heater oil shall exceed a certain minimum amount and shall not exceed a certain maximum amount.

3. Process condition restraint. Another unit associated with the crude unit in the processing scheme may be down. An exchanger on the crude unit may be out of service. These things are noted in the program, so that the computer can determine the best course of action in light of the various constraints.

Optimization procedure. Using linear-programing techniques, 54 of 161 dependent variable equations are optimized to find the proper settings for up to 19 independent variables.

Optimization yields a detailed picture of the room for improvement existing in the operating condition. Once this is established, optimization also determines the changes needed to take advantage of the projected improvement. To do this, the effects each primary variable change will have on each constrained variable must be considered.

These effects are known as response coefficients, and actual values of the coefficients have been developed from chemical engineering calculations carried out on an incremental basis. It is also necessary to know how each controlled primary variable will affect the process profit.

With the capacity to handle the 75,000 instructions involved, the computer can carry out this entire search for the best operating condition. It eliminates the need to search for the optimum by actually performing systematic experiments on the processing unit.

Control Data Sheet

The computer optimization as printed out on the automatic typewriter is shown in Fig. 2. Messages during scan and computation are items which point out conditions either impossible (such as an open thermocouple circuit) or those which are outside acceptable limits. With these messages the operator can make immediate checks on conditions in question.

Optimization points are shown inside the boxes. Values printed immediately to the left of the optimization points are those which actually exist on the unit. The operator can compare these values to see how close the unit is to optimum conditions.

The control data sheet includes charge and product rates, ASTM data, flash points, pour points, and viscosities on crude charge and products. Next come gas rate and liquid rates on intermediate streams. Tower loads, process temperatures, and utilities are also optimized.

Under the heading, **controller changes to optimize,** appear the changes which should be made in control settings on the 19 controlled variables to bring the unit to optimum conditions.

The optimization factor is an indication of how close unit operation is to the optimum. Temperatures, flows, and pressures of interest, but not controlled, are shown under the heading, **additional scanned data.**

Work needed. Most of the instructions from the computer are carried out immediately by the operators. But some refinements in the program are still needed. Now and then the operator gets an instruction that obviously does not make sense. These rough spots are rapidly being smoothed, and are expected to be ironed out by the end of the year.

One important thing to be done before the unit is put on closed-loop control is to build small steps into control adjustments which are called for in the optimization. Even though a large change may be required in the level of some variable, this cannot be made suddenly because process upsets would result. The operator makes such changes slowly, and this type of judgment must be programed into the computer.

Process monitors. Five process monitors are incorporated into the control setup. These make the program simpler; in fact, computer control of the crude unit might not be possible if none of these was available.

Four of the five monitors were developed by Standard in an effort to improve methods of instrumentation and automatic control. This mirrors the efforts of the oil industry and instrumentation equipment firms generally. It has been apparent from the first thinking that time-consuming laboratory analytical methods had to be replaced with real-time process monitoring instruments.

An analysis which takes several hours to complete is of little value in precise process control because dynamic conditions change considerably during this time.

Location of the five monitors is shown on crude-unit flow diagram, Fig. 1. The monitors are:

1. Ohmart radioactive density indicator on crude charge. The measuring element is on the crude charge line before exchange with hot products.

2. Standard Oil end-point analyzer, installed to monitor end point on heating oil.

3. Standard Oil ASTM analyzer, installed on heating-oil product stream. This instruments records five points on ASTM distillation. The temperatures for each of these points is fed into the computer for determining ASTM distillation curve.

4. Standard Oil viscosity controller. This instrument controls the amount of light cycle oil from cat cracking to be blended in with vacuum bottoms to make residual fuel of about 150 S.s.U. at 210° F. (Fig. 1).

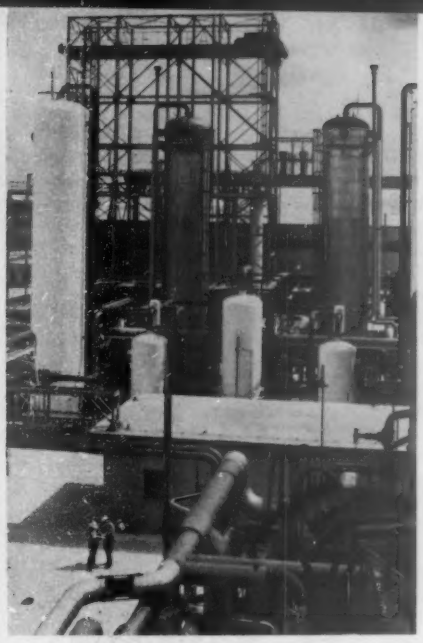
5. Standard Oil continuous flash-point recorder, also installed on heating-oil product.

The company is also developing more process monitors which will give analytical results in real time, and thus will greatly improve conventional automatic control, as well as computer control.

Mercaptan analyzer, now in refinery use, provides significant cost reduction in gasoline-sweetening processes. A cycle can be completed in 3 minutes.

Bromine index titrator has proved in refinery application that automatic, correct analyses can be made for olefins, even in the presence of aromatics. Each cycle of this new instrument takes only 6 to 8 minutes.

Pour-point monitor gives automatic, accurate pour-point readings on a 15-minute cycle. A sample is cooled while an optical system watches for frost. The temperature of formation of first frost is the pour point. This unit, good to 1° F. instead of the 5° F. of conventional equipment, is now working well in several installations.



CONTROL BUILDING (center) houses control computer for direct, on-line control of Monsanto Chemical Co.'s ammonia unit at its Barton plant in Luling, La. Fig. 1.

COMPUTER-CONTROL CONSOLE in control room views the control-instrument panel board. Long-carriage typewriter on top of console logs operating data. Short-carriage typewriter in front of operator types record of selected signals that computer sends to control instruments, and also feeds any orders into the system by operators. Fig. 2.

. . . and here's how

Closed-loop computer control is used on an ammonia plant

FIRST CHEMICAL PLANT to be computer-controlled is Monsanto Chemical Co.'s ammonia unit at the Barton plant near Luling, La.

It is the first really significant step in 25 years to improve both the efficiency and productivity of ammonia synthesis.

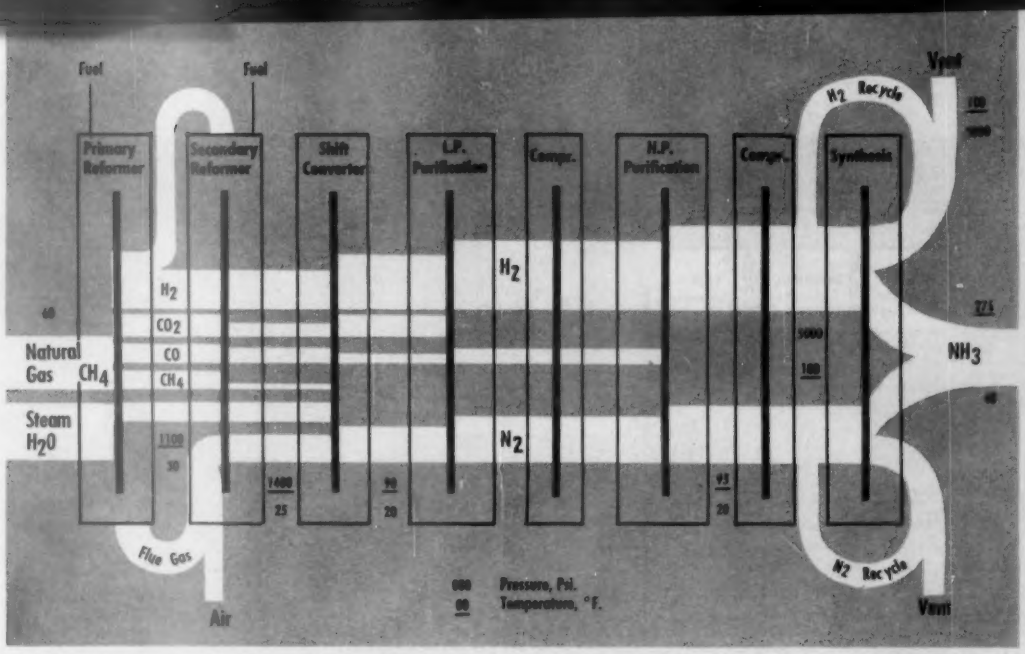
Last week Monsanto opened the doors of its computer-controlled ammonia plant there. Here are some of the details.

- **The entire ammonia unit** has been on closed-loop computer controlled since early January 1960. The computer has increased production a few per cent for the 500 ton per day ammonia plant.

BY H. C. BOZEMAN
Gulf Coast Refining Editor

- **The computer calculates and sets** the set points for existing pneumatic instruments and, thus, is a supervisory control. Statistics of past operation were used to make the mathematical model. The computer program is algebraic and uses adaptive control and stream analysis by gas chromatography. The mathematical model is a steady-state, not a dynamic, model.
- **The control calculation** is made every 16 minutes. The computer is used about 60% of the time for control, and idle time will be used for engineering and cost-control work. The computer doesn't save either operating or maintenance personnel; instead it increases both. A higher level of instrument maintenance is needed.

CONTROL COMPUTER (center left) digests input data to compute the set-points of control instruments. An input-output panel is at right. Fig. 3.



MAJOR STEPS in ammonia process are reforming, CO converting, low and high-pressure purification, and synthesis. Fig. 4.

● **Total cost** of the computer installation was at least $250,000.

Monsanto says the computer installation at the Barton plant doesn't mean that every plant will soon have a computer. There are criteria of size and complexity that must be met before a computer is justified. Monsanto's studies show that unless a small increase in profit will support the investment, the plant is probably too small for digital-computer control.

If preliminary studies show that large increases in yield or efficiency are possible, it is likely that these can be gained by engineering changes or better instrumentation.

Background

In 1955, at one of Monsanto's regular reviews of corporate engineering practices, it was decided to emphasize automatic control for improving overall return on investment.

A systems engineering section was formed in March 1957 at the company's research and engineering division. It was to investigate and adapt the techniques and methods used successfully to develop advanced control systems in other fields.

In 1957, Ramo-Wooldridge Corp. approached Monsanto with a proposal to apply its RW-300 control computer to a chemical process. The proposal was for the two companies to enter into a joint study to find if a computer could be justified at one of Monsanto's plants. After evaluating the study results, Monsanto could install a computer if desired.

In November 1957, Monsanto and Ramo-Wooldridge (now TRW Computers Co.) signed a contract for joint study of the ammonia unit at the Barton plant.

Study teams. A team of about equal numbers of engineers from each company was to study the process and in 6 months present a report to Monsanto's management. The report was to show the technical and economic feasibility of digital-computer control of the ammonia process in general and the Barton plant in particular.

The plant study work was completed in late spring 1958. The team's final report along with a proposal from Ramo-Wooldridge for a computer-control system at the Barton plant was presented in July 1958.

The report concluded that it was possible to computer-control the ammonia plant.

Monsanto's problem was to decide (1) whether such control was practical, a technical decision; and, (2) "Do we want it?" a management decision. The criteria for continuing the project were: (1) to find the capital cost for complete installation, (2) to develop the increased earnings to Monsanto, and (3) to calculate a return on investment.

A decision made previously by management was to justify the computer as a production tool, rather than as a research and development device.

The evaluation was favorable and Monsanto management announced in December 1958 it would put a computer-controlled chemical plant on stream in 1959. The computer would attempt to achieve maximum production from the plant with minimum operating cost.

A new team from both companies designed the actual installation. These personnel were from Monsanto's Barton plant and headquarters engineering department, and TRW.

The computer was built, the existing pneumatic instruments were revised and modernized for computer control, and new instruments were installed. The installation was completed and in early January 1960 the computer went into full operation after checkout in late 1959, Fig. 1.

Choosing the Process

The computer installation is the result of work in systems engineering and electronic computation. Systems engineering is concerned with the way parts of a system work together and how they can be controlled. Mathematical models are the basis of systems engineering which is made possible only by electronic computers.

Here's why the ammonia plant was chosen for computer control.

1. A reasonable improvement was needed to justify the expense of a computer. This set a minimum value of production per unit time which could be considered.

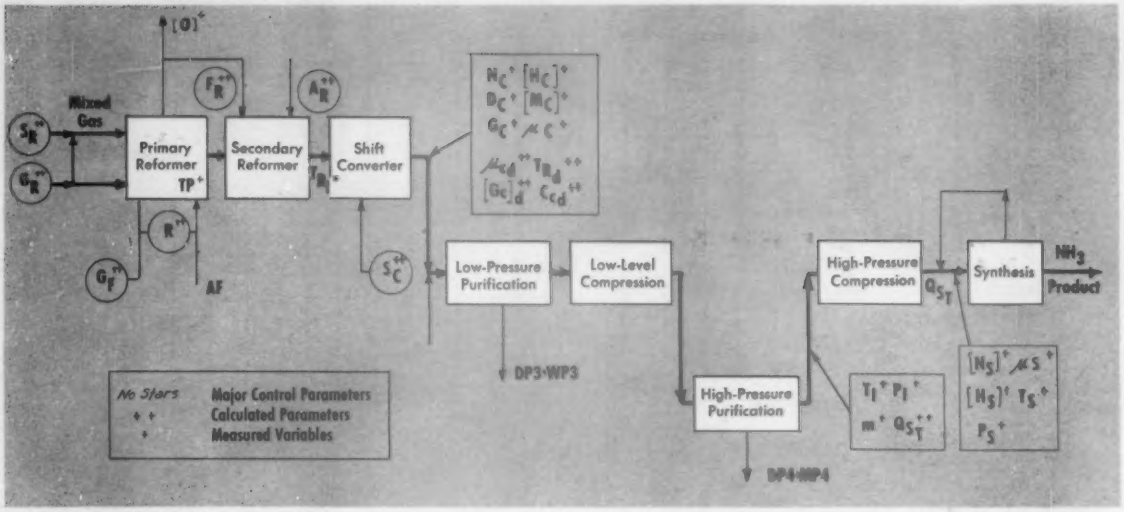
2. A process that would not disclose company secrets. The ammonia process was chosen because it is well known and plant design is freely available.

3. A modern, well-instrumented plant was needed, so the computer could be judged on its own merits. The Barton plant built in 1954, is highly instrumented.

Cost of Installation

The capital cost of the installation consisted of the computer itself, a fixed fee for TRW engineers, cost of modifying existing instruments, and cost of new instruments.

Costs of instrumentation represented a major uncertainty, especially when making a first computer installation. Even with a well-developed



OVER-ALL OUTLINE of computer control of the ammonia process. The important plant control variables are shown. They must be investigated in the computer control study. Fig. 5.

predesign study the final costs were slightly above estimated costs. Monsanto found that a conservative approach to estimating costs was wise. Otherwise, final costs would have far exceeded estimates.

Estimating the profit return from the computer installation was a matter of engineering evaluation because no experience with process control computers was available.

The computer has been justified on the basis of maximizing production. It has increased production the few per cent (in the range of 1 to 2%) that calculations showed.

What Computers Can Do

A computer can return costs by increasing product for sale, reducing cost of production, increasing efficiency of raw material use, or improving product quality.

The computer can minimize the effect of uncontrolled variables such as air temperature. It can calculate mass flow rates for control and print them on data-logging typewriters for non-control uses, Fig. 2, during start-up and off-control periods.

There is no need to wait until the process comes to steady state before making adjustments to variables. This is significant in a process with lags as long as a complete ammonia plant. Also, the computer, Fig. 3, can cope with rapid or short time change, but manual control cannot.

The computer can handle intermittent data as well as continuous data. It can calculate plant and unit efficiency on any desired basis. The computer can calculate flow rates that are compensated for pressure and temperature.

TABLE 1

1. Primary control variables of an ammonia plant
   - (a) Reaction gas flow to primary reformer, G_R
   - (b) Air flow to secondary reformer, A_R
   - (c) Flue gas flow to secondary air blower, F_R
   - (d) High-pressure steam to primary reformer, S_R
   - (e) Low-pressure steam to shift converter, S_C
   - (f) Fuel-gas flow to primary reformer furnace, G_F
   - (g) Fuel-air ratio, primary reformer furnace, R
2. Basic measurements and calculated factors in ammonia plant control
   - (a) Desired synthesis gas feed rate, Q_S
   - (b) H_2:N_2 ratio at synthesis reactors, μ_S
   - (c) H_2:N_2 ratio at shift converters, μ_C
   - (d) Fuel gas content at shift converters, G_C
   - (e) Secondary reformer temperature, T_R
3. Objectives of computer control
   - (a) Maintain maximum gas flow in spite of changing weather and process conditions
   - (b) Maintain optimum hydrogen to nitrogen ratio
   - (c) Maintain optimum methane concentration at shift converter exit unless in conflict with a or b
   - (d) Maintain maximum shift efficiency if not in conflict with a through c
   - (e) Under reduced flow conditions (storage tanks, fuel, etc.) maintain b through d
   - (f) Immediately and safely reduce raw materials flows to compensate for any loss of compression
   - (g) Provide a log of important process variables
   - (h) Provide operator with messages in case of abnormal process or instrument conditions
   - (i) Provide fail-safe features that detect, alarm, and prevent instrument and computer malfunctions from affecting the process
   - (j) Control fuel and air to reformer furnace
   - (k) Maintain specified steam to dry gas ratio at secondary reformer exit and at shift converter exit

The Ammonia Process

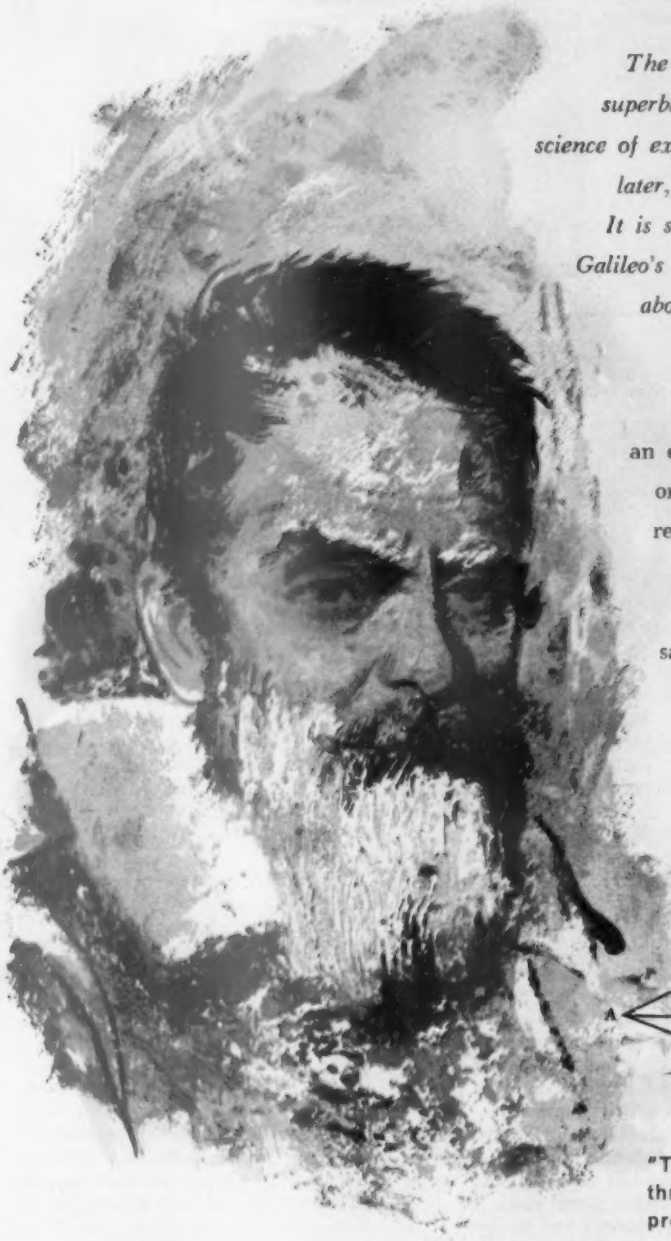
A block diagram, Fig. 4, shows the approximate pressures, temperatures, and analysis of the flow streams. The plant consists of the following units:

1. Primary reformer reacts steam and natural gas (methane) over a catalyst to make hydrogen and carbon monoxide. External heat is supplied for the endothermic reaction.

2. Secondary reformer burns some of the hydrogen from the primary reformer with air to supply heat for further catalytic conversion of methane and steam, and remove almost all oxygen. The flue gas from the primary reformer is the nitrogen source for ammonia.

3. Shift converter or CO converter converts most of the remaining carbon monoxide by the "water–gas-shift" reaction to hydrogen and carbon dioxide.

THE QUALITY OF THINKING



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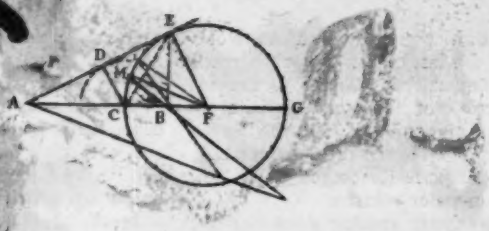

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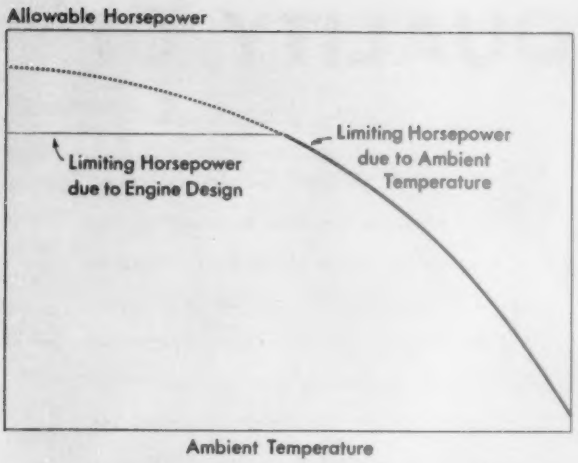
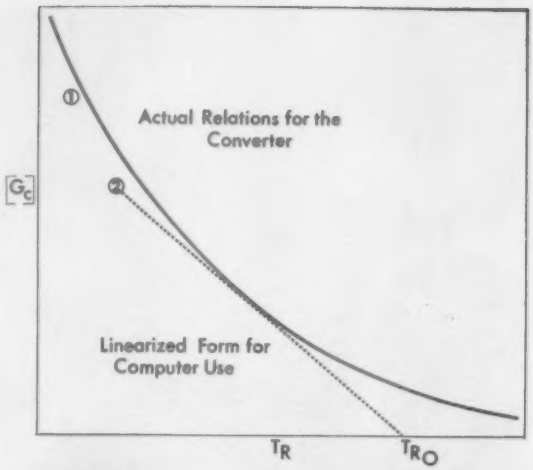

Allowable Horsepower
Limiting Horsepower due to Engine Design
Limiting Horsepower due to Ambient Temperature
Ambient Temperature

EFFECT OF TEMPERATURE on allowable engine horsepower ambient conditions, particularly temperature, influence internal combustion engine efficiency. Fig. 6.



RELATIONSHIPS of secondary reformer temperature and feed-gas conversion efficiency. The slope of curve 2, B_R, is determined experimentally and used to correct the stored value of B. Fig. 7.

4. Low-pressure purification removes as much as possible of the carbon dioxide by absorbing it in monoethanolamine. It is the first step in purifying the synthesis gas.

5. Compressors. The ammonia reaction involves an equilibrium between nitrogen and hydrogen, and ammonia product. Equilibrium is displaced to more ammonia product by higher pressures and lower temperatures. But, low temperatures reduce the reaction rate and require a larger reactor for the same ammonia product rate. Therefore, synthesis reactor and compressor system must be designed together for the most economical combination of compressor presure and reactor size for required product rate.

6. High-pressure purification removes the last traces of carbon monoxide and carbon dioxide to prevent destruction of the synthesis catalyst. Carbon monoxide is absorbed in a copper ammonium formate solution. Carbon dioxide is absorbd by an ammonia-in-water solution.

7. Synthesis reactor combines N_2 and H_2 catalytically to form ammonia. Product ammonia is separated from reactor effluent by refrigeration. Unreacted gas is cycled with the incoming gas. A small vent from the recycle stream prevents buildup of inert argon and neon.

Ammonia Process-Control Requirements

The synthesis unit should be operated at its design pressure and temperature, and fed the correct proportion of H_2 and N_2. The chemical equation:

$$3H_2 + N_2 \rightleftarrows 2NH_3 \qquad (1)$$

indicates a ratio of 3:1. The ratio is not exactly 3.0:1 predicted by reaction formula because these gases have different solubility in product ammonia. Maximum conversion is at a slightly different ratio.

The exact value of the ratio varies from plant to plant and must be determined experimentally. The ratio is maintained by regulating the ratio of H_2:N_2 at the shift converter exit which also varies from plant to plant.

Primary reformer variables are: reformer temperature, total natural-gas feed, and total steam feed as a ratio of natural-gas feed. A separate furnace combustion control maintains reformer temperature.

The secondary reformer has two main variables which are: ratio of air flow to process gas flow from primary reformer, and ratio of flue gas to process gas.

The addition of flue gas allows independent regulation of H_2:N_2 ratio and reformer temperature. Thus, it permits low methane content in the output for efficient operation.

In the shift converter, the proper amount of steam must be added to convert the CO to CO_2. The H_2:N_2 ratio is shifted from about 2.7:1 at secondary reformer exit to about 3.1:1 at shift converter exit.

Heat exchangers preheat primary reformer feed gas for utilities savings. Synthesis gas is compressed in five stages to 5,000 psi. for synthesis.

The important plant control variables which may be used by the computer are shown in Table 1 and Fig. 5. These variables must be investigated in the computer control study.

The Plant Study

The joint-study team developed a mathematical model by which a computer might control the process. The same model, with addition of proper economic factors, can be used to find economic return possible from computer control.

The model is a series of arithmetic and algebraic statements of relationships of dependent process variables to independent variables and process parameters. Thus, a model may express the total plant production (a dependent variable) to the effect of ambient air temperature (an independent variable) and the number of available compressors (a process parameter).

Theoretical expressions covering required relationships did not exist and could not be readily developed. Statistical studies were made of available plant data to find empirical relationship between dependent and independent variables, and plant operating parameters.

The procurement of accurate plant data was a significant part of study work. Regular plant log sheets were used whenever possible, particularly for those factors reflecting seasonal variations of plant operation and its dependence on ambient conditions. In other cases, special plant runs were made for a particular correlation.

It was decided early that the computer should operate "on-line" and the operator would not translate the computer's finds into plant process changes. The computer would exercise "supervisory" rather than "dynamic" process control. It would alter set points of regular plant instruments instead of directly changing valve settings.

The model would compute desired values of several process parameters to

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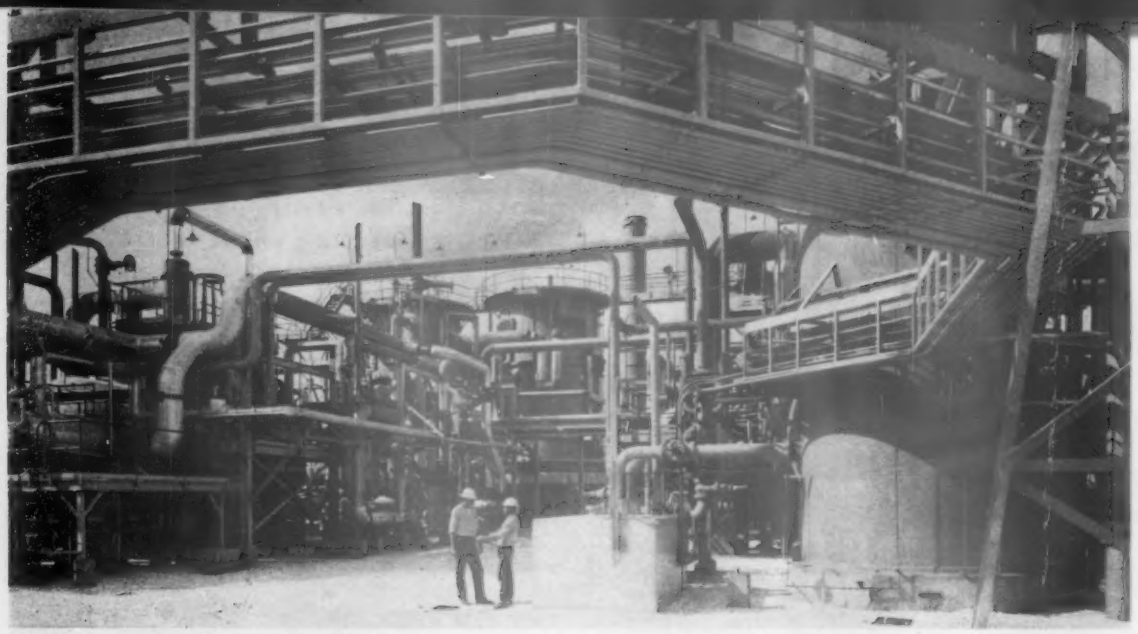

ELEVATED BANKS of input and output instrument lines connect the computer into the ammonia process unit. Control building is barely visible at left. Fig. 8.

use to calculate set points of plant flow quantities. The principle of adaptive control was applied with equations which would slowly modify the model for computing process parameters, should the original model not follow exactly the physical system.

Also, after the computer was installed many controller constants could be determined by trial-and-error adjustment. Actual forms of the control equations could be altered under operating conditions as plant results showed the need.

Therefore, the model was set up to be hand-fitted to the Barton plant ammonia unit and to be uniquely capable of controlling that unit. It would be in a state of evolutionary developments as fine adjustments were made to process and control constants.

Here are some examples of control relations developed for the ammonia process by the study team.

Effect of ambient temperature. Air temperature is an uncontrolled variable and affects unit capacity. Production can be improved by optimizing plant conditions as air temperature changes.

Data showed that plant capacity was greater in winter than in summer. Even the sudden drop in temperature associated with thunderstorms permitted a capacity increase. The relation of production vs. temperature was obtained from past operating records.

The plot showed a broad band of points with increased production as the temperature decreased. A regression analysis produced a function that when shifted up to pass through the maximum points gave an indication of maximum production expected at any temperature.

The increase in production over a year was predicted from these data. Monsanto, to be conservative, assumed it would realize only a two-thirds improvement between original and maximum.

Monsanto prepared similar analyses for other variables affecting yields, throughput, and efficiency. The sum of these credits was substantial. Costs were deducted from the credits for depreciation, maintenance, training of personnel, and higher operating costs.

Maximum gas-flow computation. The engine-compressor system may be the first bottleneck as production increases. It represents a major part of the capital cost of an ammonia plant. The highest production rate and the maximum economic return are obtained by operating the compressor system at capacity.

Ambient conditions, particularly temperature, influence internal combustion engine-compressor efficiency. The allowable horsepower for compression follows a graph similar to Fig. 6.

Total horsepower is regulated by adjusting gas flow to synthesis. One computer task is to calculate the allowable flow of synthesis gas for the horsepower available and regulate it at this level. Total required flows less than maximum can be handled similarly, if desired.

Allowed flow, Q_S, is computed by an empirical equation which is specific to each type of compressor and where

$$Q_{Shp} = f\,(m, hp, X, T_1, P_S, P_I) \quad (2)$$

All symbols are defined in Table 2.

The limiting Q_{Shp} is compared with desired production gas flow rate, Q_{Sd}, and the lower is chosen as Q_S for plant control.

Should the new calculated Q_S be different from the actual value, the Q_S control must be altered to bring the plant into line. Plant inertia places a limit on the rate at which it can be done. Thus:

$$Q_{S\,(new)} = Q_{S\,(old)} + \min \left\{ \frac{(Q_{S\,(new)} - Q_{S\,(old)})}{\pm mk_I} \right\} \quad (3)$$

TABLE 2—SYMBOLS USED

A	Total air flow, subscript indicates location.
B	Slope of a curve of unreacted gas vs. reformer temperature.
C	Carbon dioxide-carbon monoxide ratio. As first subscript, indicates shift converter.
D	Carbon dioxide flow.
F	Flue gas to reformer. As first subscript indicates reformer furnace.
G	Natural gas flow.
H	Hydrogen gas flow from converter.
I	As first subscript, indicates inlet of compressors.
M	Carbon monoxide flow.
N	Nitrogen gas flow.
O	Oxygen.
Q	Total gas flow.
R	Fuel-air ratio in reformer furnace.
S	Steam flow. As first subscript, synthesis unit.
T	Temperature. As second subscript, total amount.
W	Water flow.
d	As second subscript, desired value.
k	Arbitrary constants.
m	Number of compressors on line.

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SAVE MAKE-UP TIME ASSURE PRESSURE TIGHT JOINTS

Careful inspection assures true alignment for faster make-up. Army-Navy gauging procedure guarantees full formed threads for pressure tight joints with any CAPITOL screwed fitting. The same care and skilled workmanship for all classes of CAPITOL pressure fittings assure trouble-free installations.

COMPLETE PROTECTION FROM CORROSION

All CAPITOL fittings are fully protected against corrosion. Job-determined coatings that have proved most effective are applied according to general uses of each type of fitting. Special coatings are available when needed.

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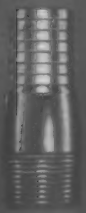
Specify CAPITOL to assure job-tested fittings. Steel fittings assure no sand holes, no porosity. Every CAPITOL fitting equals or exceeds all published specifications for its size and pressure. All are conveniently packaged and protected to ensure delivery in factory finish condition.



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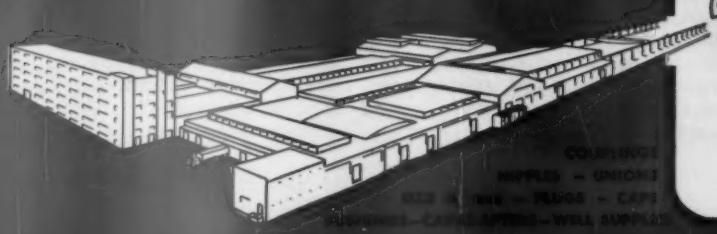


CAPITOL MANUFACTURING CO.
DIVISION OF HARSCO CORP.
COLUMBUS, OHIO

REMOTE INSTRUMENT is checked. It feeds reports to the computer in the control building, hidden behind tanks and towers. Fig. 9.

- n Number of carbon atoms in the formula, C_nH_{2n+2}. For hydrocarbon fuel gases, n = 1.05.
- 3 As third subscript, refers to low pressure purification.
- 4 As third subscript, refers to high pressure purification.
- hp Horsepower.
- [] Used around any symbol, indicates composition.
- μ Ratio of H_2:N or H_2:N_2, subscript refers to location.

where the sign of mk_1 is the same as the sign of $(Q_{S\,(new)} - Q_{S\,(old)})$, k_1 is some limiting rate of compressor volume change.

Factor m, number of compressors on line, allows the computer to automatically account for compressor failure or availability of more compressor capacity.

Desired ratio at shift converters. The carbon dioxide is removed from synthesis gas after shift conversion. Thus, the total gas flow is different at the shift converter.

The ratio of H_2:N_2 in the total gas (actual average of both streams) is μ_{CR}, while the ratio of H_2:N_2 at the synthesis unit is used as the composition ratio and is symbolized as μ_{SR}.

A method for correcting μ_C to counteract upsets in synthesis converters is as follows:

$$\mu_{Cd} = \mu_{C\,(old)} + k_3\{[3.1+k_4(2.6-\mu_{SR})] - \mu_{CR}\} \quad (4)$$

Actual values of k_3 and k_4 depend on process dynamics.

Desired reformer temperature. A correlation of unreacted feed gas, $[G_C]$, content in shift converter effluent vs. secondary reformer reaction temperature is shown in Fig. 7, Curve 1. Curve 1 can be linearized as Curve 2. The slope of Curve 2, B_R, is determined experimentally and used to correct the stored value of B:

$$B_d = \frac{B_{old} + k_5 B_R}{k_5 + 1} \quad (5)$$

$[G_C]$ can then be calculated to free the computer from dependence on analytical instruments:

$$[G_C]_d = B_d (T_{Ro} - T_R) \quad (6)$$

Other programs were necessary to prepare the complete mathematical model of the process. Some relationships that were made were for control of secondary converter temperature, desired carbon dioxide-total carbon ratio, computation of over-all process input flow rates, and a furnace temperature-control program.

Installing and Maintaining the Computer

Actual design began after Monsanto's management granted approval to proceed. A new team of specialists from both companies made the installation. TRW furnished electronic specialists, programers, systems analysts, and a project engineer. Monsanto had a project engineer, instrument engineer, and several process engineers.

The computer itself was built after approval. The programs were written for the computer and debugged. Monsanto technical and hourly personnel attended a computer maintenance school at the factory.

It was decided at the start of design and engineering to use existing pneumatic instruments. The decision was based on initial cost of a new electronic system and existing pneumatic instruments were doing a good control job, Fig. 8.

The ammonia plant operated at maximum rates during installation and close coordination between operations and construction was needed. Also, the type of instrument system used affected the installation.

The computer controls the same variables that the operator originally controlled. The difference is that the computer calculates the proper value and sets the instruments, whereas the operator manually set them before.

The computer uses the same information that was used for manual control, except for pressure and temperature of a few variables for flow compensation.

The process information before computer installation was in pneumatic form. For the computer, the pneumatic signals are converted to an electrical signal in transducers. Any new instruments are electronic and send their signals directly into the computer. The computer's electrical output is transduced into pneumatic signals for the pneumatic instruments.

Each instrument set by the computer has a selector switch to choose either computer or local control. The computer will not make portions of the control calculation if particular instruments are on local control.

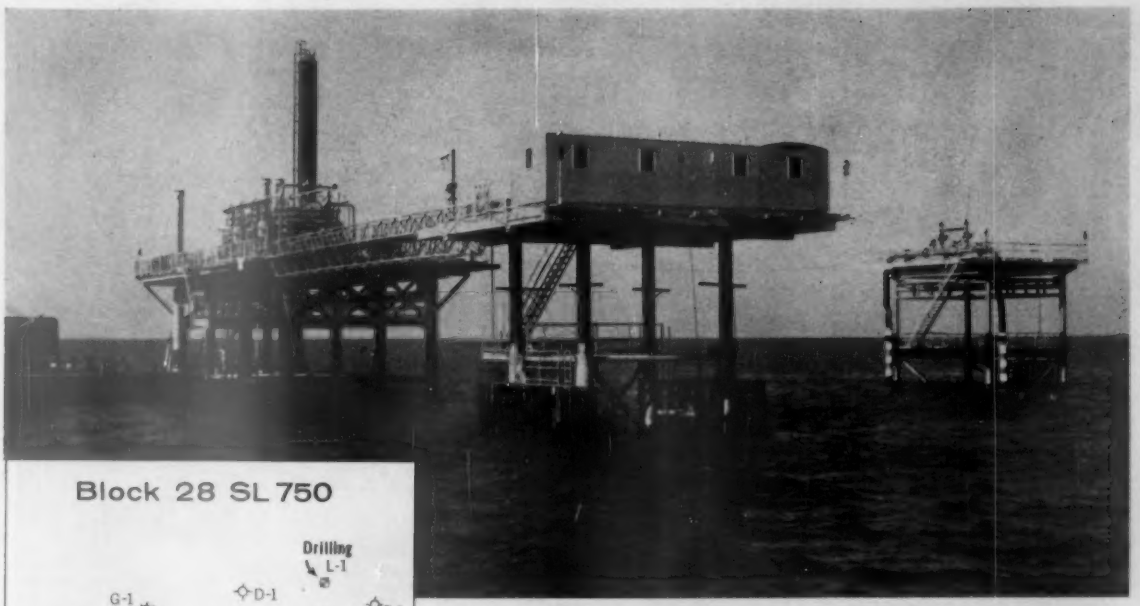
The operator has a control panel that shows the status of the control system. He can transfer to and from computer control from the panel. A logging typewriter records helpful process information, and another typewriter announces undesirable or unsafe conditions detected by the instrument-scan program.

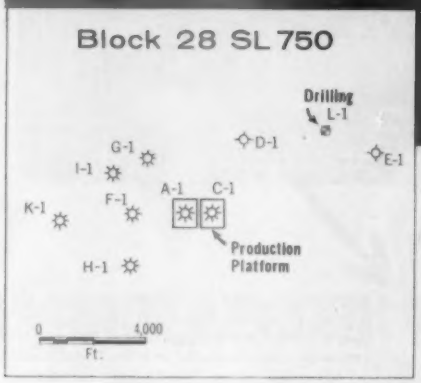
Fail-safe devices are built into the control system to protect against instrument and power failures.

The carefully prepared mathematical model of the ammonia unit is changed on the basis of newer data and more detailed study. During the time of computer installation new process equipment was added which changed process conditions and an almost completely new mathematical model was needed.

Maintenance. The computer manufacturer maintains the computer proper. The machine has been reliable, Monsanto says. Plant personnel maintain the instrument system surrounding the computer. The same instrument men that maintained the original system and installed the computer are doing the instrument work now, Fig. 9.

Formal training was not overlooked. Hourly maintenance men are enrolled in the manufacturer's computer-maintenance course. Electrical and instrument foremen and an electrical engineer have completed programing and maintenance prerequisite courses.





SHIP SHOAL BLOCK 28 FIELD produces condensate through the facilities on this platform. Gas streams from all wells shown in the map converge at the platform on the left. Crew quarters are on the center structure. To the right is Transcontinental Pipeline Co.'s receiving and measuring station. All wells in Block 28 field are equipped with surface and subsurface safety valves. The risers on the platform are protected by piston-operated valves that may be remotely controlled from the crew quarters 100 ft. away. A safety valve upstream of the low-temperature separators is operated automatically by pressure on the separation equipment.

Here's how Kerr-McGee handles offshore condensate

• Specially built separation and delivery points collect, separate, and distribute gas and liquids from offshore condensate wells. Platform instrumentation permits remote control of producing wells and other parts of the system.

BY W. B. BLEAKLEY
Production Editor

OFFSHORE LOUISIANA is getting crowded these days.

Not with drilling platforms, necessarily, but with gas-handling facilities.

One of the major contributors to this flurry of activity is Kerr-McGee Oil Industries, Inc. This firm is now operating three gas-condensate separation and dehydration plants offshore and there are more on the way.

Recent addition. Latest in the Kermac system is the platform at Ship Shoal Block 28 field, offshore Terrebonne Parish. This one is located about 42 miles south of Morgan City in 12 ft. of water.

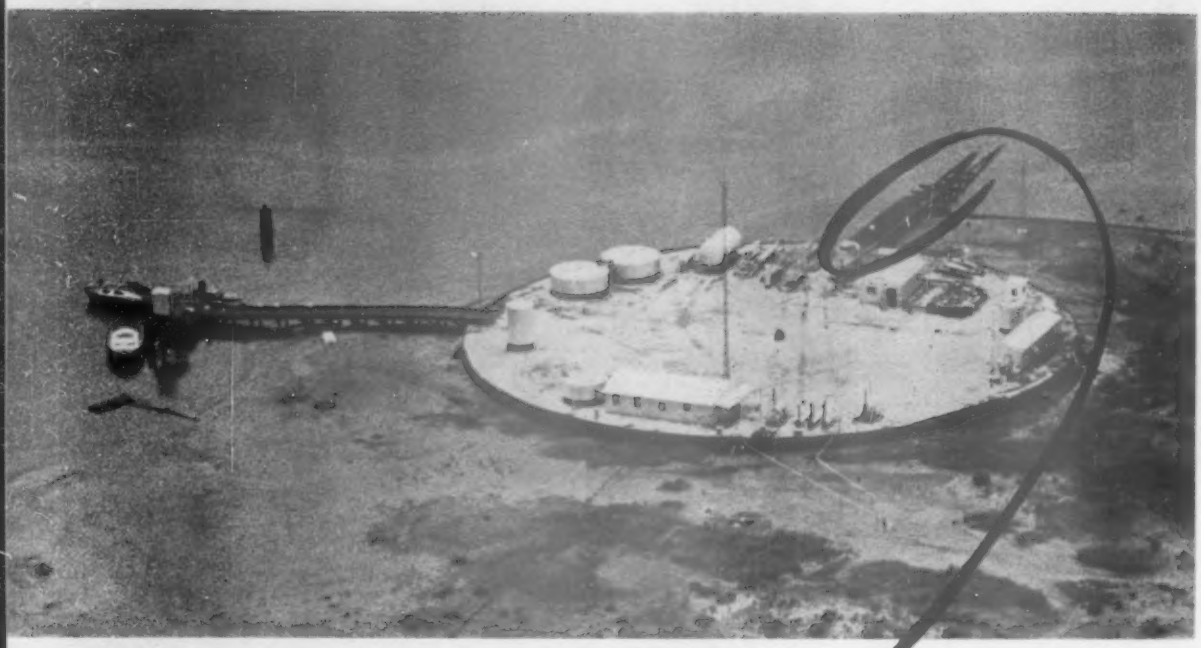
Other central separation and delivery points have been in operation for some time. They are located at Breton Island, southwest of New Orleans, and at Main Pass gas field, south of the Mississippi delta.

What they do. All of these facilities have the same job. They collect gas-condensate from wells in their respective fields, remove the free water, separate out the heavy hydrocarbons, and deliver the residue gas to pipeline.

How they do it. The Breton Island and Main Pass plants operate on a low-temperature glycol cooling-separation cycle. The newest plant at Block 28 field throttles the gas from plant input pressure to 1,000-psi. pipeline pressure. Input pressure varies from 2,800 to 4,000 psi. which is high enough to provide the cooling effect needed for efficient separation.

Construction

The plant at Breton Island, the first one built by Kerr-McGee, is located on a man-made island. Sheet piling



BRETON ISLAND FACILITIES are built on a man-made base 220 ft. in diameter and 10 ft. above high tide. Sheet piling was used to build a cylindrical tank which was later filled with dredged sand. In photo at left, the small lines gather gas from wells surrounding the island. The larger pipe delivers dry gas to Southern Natural Gas Co. in Toca, Louisiana. G. E. Guidry, division production superintendent, is shown with foot on section of pipe used to repair larger line.

was used to form a cylindrical tank 220 ft. in diameter and 10 ft. above high tide.

This man-made land area was built on top of the natural Breton Island, a water-level, C-shaped land mass 80 miles southeast of New Orleans. The cylindrical shell was filled with sand dredged from the boat landing and turning basin.

Too wet, but not wet enough. Breton Island Block 36 gas field was discovered by Barnsdall Oil Co. in 1948 with a dry gas well. But it was shut in, and there was no further development until Kerr-McGee and Phillips Petroleum Co. bought the leases in 1951.

Water depth around Breton Island, where wells were to be staked, varied from 2 to 6 ft., too wet for land-based equipment, but not deep enough for drilling barges, crew boats, etc. Dredging was needed, and the spoils were used in preparing the location for the plant.

Conventional platforms. Kermac's two other plants are located on more conventional steel platforms. Actually, there are two platforms at each location. One of them is for gas-handling equipment, and the other contains crew quarters, communication equipment and instruments.

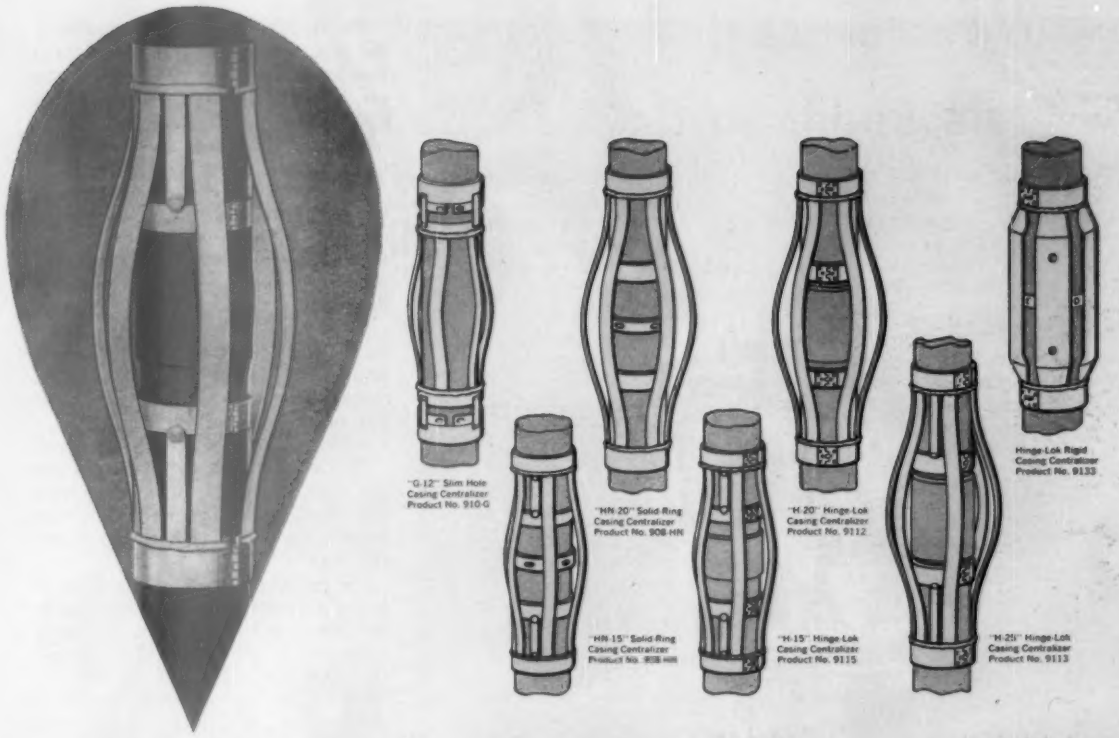
The Main Pass platform was completed in December 1947 and the Ship Shoal Block 28 plant was finished in 1960.

Gas Supply

Two fields supply gas to the Breton Island plant. One is the original Breton Sound Block 36 field discovered in 1948. The other is the Breton Sound Block 20 and 32 fields. This one was tied into the system in 1958.

Equipment on Breton Island is separated into two distinct parts. One side handles Block 20 and 32 gas, the other handles Block 36 gas. Kerr-McGee and Phillips share equally in the field and handling equipment, with Kermac being the operator.

Main Pass plant handles only gas from nine wells in Main Pass field.


"G-12" Slim Hole Casing Centralizer Product No. 910-G
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"HN-15" Solid Ring Casing Centralizer
"H-15" Hinge-Lok Casing Centralizer Product No. 9115
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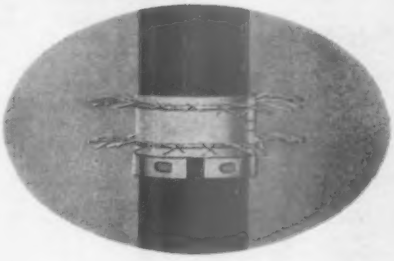
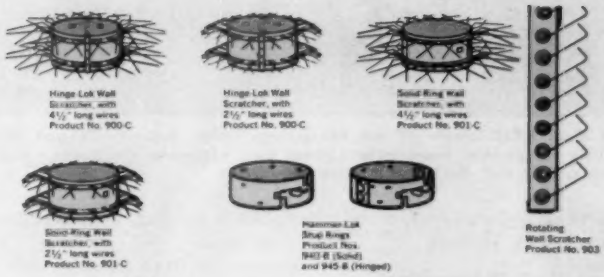
A good cement job starts with two things




Hinge-Lok Wall Scratcher, with 4½" long wires Product No. 900-C
Hinge-Lok Wall Scratcher, with 2½" long wires Product No. 900-C
Solid-Ring Wall Scratcher, with 4½" long wires Product No. 901-C
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MAIN PASS GAS FIELD south of the Mississippi Delta delivers its gas to this platform. This is another installation using two separate structures, one for gas-handling equipment, the other for crew quarters.

and the new plant gets its supply from the Ship Shoal Block 28 field.

Ship Shoal Block 28 Operations

On completion of the platform and equipment installation, four wells were connected to the handling system.

Wells were drilled by submersible barge. Completed wells, with trees, are protected by a 7½-ft-diameter caisson driven into the ocean floor. Five wells have been drilled and completed to date by submersible barge. A sixth well which is an east stepout development well is presently being drilled.

Flow lines from the wells to the platform are 4 in., and vary in length from 3,000 to 4,150 ft. Two of the wells, F and H, are completed in the 13,600-ft. sand and the others, G and I, are completed in the 14,000 ft. sand. Three of the wells are completed with 3½-in. tubing, the F well with 2½. Flowing wellhead pressure in the F well is quite a bit less than the other completion in that reservoir due to smaller tubing.

Production from the four wells can be controlled by chokes on the manned platform. This means that frequent trips to the wellsite are unnecessary, and that the system can be shut down in case of extreme weather. (All Kermac plants in the Gulf of Mexico were shut in while Hurricane Donna was trying to decide which way to go.)

Design capacity for the platform is 80 M.M.s.c.f. per day. Flowing pressures at the plant are expected to be 2,900 psi. for the F well and 4,000 psi. for the H well, both producing from the same reservoir. Flowing pressure for the 14,000-ft. sand producers will be 2,500 psi. At the approximate rate of 20 M.M.s.c.f.d. per well, gas is expected to reach the platform at a temperature of 140° F. If the rate drops down to 5 M.M.s.c.f.d. per well, or less, the temperature is expected to be only 85° F., assuming a water temperature of 50 F.

On reaching the platform, each of the four well streams is routed to a free-liquid knockout. From there the gas is choked into the low-temperature separators. Liquids from the free-liquid knockouts are dumped to the liquid sections of the LTX units.

Low-temperature separator bottoms are heated by steam in coils and then dumped through a manifold to a flash separator. After stabilization the produced liquids are barge-stored near the platform.

Two flash separators are installed on the platform. One is sized for well testing and the other is designed to handle the maximum capacity throughput of the system. A p.d. meter is installed with the test flash separator.

Meter runs are installed on the tail-gas end of each low temperature separator. Individual well-production records are compiled from the meter-run data.

On production tests of less than 24 hours' duration, using LTX equipment, the stock-tank liquid-sales gas ratio averaged 34 bbl. per M.M.c.f. for the 13,600-ft. sand and 66 bbl. per M.M.c.f. for the 14,000-ft. reservoir. Analysis of the fluids from both reservoirs is shown in Table 1.

TABLE 1—ANALYSIS OF RESERVOIR FLUIDS, SHIP SHOAL BLOCK 28 FIELD

Component	13,600-ft. Sand Mole %	14,000-ft. Sand Mole %
N_2	0.09	0.13
CO_2	0.98	1.22
C_1	89.78	87.62
C_2	4.05	4.85
C_3	1.74	1.92
IC_4	0.48	0.67
NC_4	0.51	0.65
IC_5	0.19	0.35
NC_5	0.25	0.22
C_6	0.34	0.45
C_7+	1.59	1.92
Sp. gr. sep. liquid	0.82	0.78
Sp. gr. sep. gas	0.62	0.62

Ownership

All of the plants described here are operated by Kerr-McGee, but ownership is divided.

The Breton Island installation and producing fields are equally owned by Kermac and Phillips.

Main Pass gas field and platform are owned equally by Kermac and Union Oil of California.

Ship Shoal Block 28 field and plant are owned three-eighths by Kerr-McGee, and five eighths by Southern Natural Gas Co. and Phillips, combined.

Gas Sales

Residue gas from the Main Pass and Breton Island plants is sold to Southern Natural Gas Co.

Transcontinental Pipeline Co. buys the residue gas from Block 28 plant.

W. L. NELSON, Technical Editor and Petroleum Consultant

Light-oil treating — 1. Cost of chemicals

TWO MAIN OPERATIONS are required in the treating of light oils (napthas through distillates): (1) removal of hydrogen sulfide, and (2) sweetening for elimination of mercaptans. The bulk of the sulfide is eliminated in the refinery gases but that which is dissolved in the liquid is removed by caustic washing as indicated in Table 1. Refer also to Process Costimating No. 49, June 1, 1959, p. 180, which shows other operating costs of caustic washing.

The approximate amounts of chemicals used in the sweetening processes are shown in Table 2 (note that caustic for hydrogen sulfide is not included). Processes should not be compared on the basis of cost alone because quality of product is vitally important. Thus a gasoline product that has a high susceptibility to TEL (low in sulfur) represents such a large saving in TEL that the cost of conducting the treating process may not be greatly significant.

Some products, notably kerosine, are filtered through clay for neutralization or to attain stability of color. As much as 5 lb. of clay per barrel is used although as little as 0.1 lb. is sometimes useful in coagulating sludges. Most catalytically cracked gasolines can be sweetened by the use of inhibitors of the p-phenylenediamine type, and 3 8 lb. per 1,000 bbl. of inhibitor has been used. Lead sulfide is being increasingly used as a catalyst for conducting the doctor-sweetening reaction. The chemical cost is said to be under ½ cent per barrel (1955).

The total cost of chemicals includes that required for (1) hydrogen sulfide removed, (2) some type of sweetening, (3) reduction of sulfur in high-sulfur products (use of acid or hydrogen treating), (4) finishing operations if any, and (5) additives (Process Costimating No. 81, Oct. 10, 1960, p. 248).

TABLE 1—CAUSTIC WASH FOR H_2S REMOVAL*

	lb. caustic per 1,000 bbl. product	1956 cost, ct. per bbl.
Straight-run distillates to 550° F.		
from sweet crude oils	0.6- 2.7	0.002-0.011
from stabilized sour crude oils	5.9- 16.5	0.023-0.066
from sour crude oils	7.6- 270.0	0.03 -0.108
Cracked gasolines		
from 0.5% S, Mid-Continent crude oil	† 94 - 580	†0.37 -2.32
from 0.8% S, Venezuela crude oil	† 84 - 396	†0.33 -1.58
from 1.0% S, West Texas crude oil	† 94 - 415	†0.37 -1.67
from 1.5% S, Mid-Continent, Venezuela, Middle East	†140 -1,085	†0.56 -4.35
from 3-4.5% S, Middle East or West Texas	†282 -2,340	†1.13 -9.35

*The caustic is permanently destroyed in combining with hydrogen sulfide, hence no regeneration is possible.

†Much of the hydrogen sulfide is removed by fractionation if the amount is large, hence these large consumptions of caustic are seldom encountered.

TABLE 2—CHEMICAL REQUIREMENTS OF TREATING PROCESSES* AND CHEMICAL COSTS (1956)

	Caustic soda*	Litharge	Sulfur	Copper ‡chloride	Salt	Earth	Total (probable extremes)	Total, average
1956 price, ct./lb.†	4	24	6	40	1.3	5	.....	...
Doctor sweetening*								
lb./1,000 bbl.	2-20	5-50	5-10	.....	.....	.....	.....	...
ct./bbl.	0.01-0.08	0.12-1.2	0.03-0.06	.....	.....	.....	*0.15-1.2	*0.65
Copper chloride*								
lb./1,000 bbl.	(*)	.....	.....	2-6	2-40	7-20	.....	...
ct./bbl.	(*)	.....	.....	0.08-0.24	to 0.05	0.03-0.15	*0.12-0.4	*0.2

	Caustic soda*	Sulfuric acid	Methanol	Potassium hydroxide	Cresylic acid	Others	Total (probable extremes)	Total, average
1956 price, ct./lb.†	4	¶1.5	§38	11	§90	.....	.....	....
Acid, s.r.gaso., jet, solvents, stove oil								
lb./bbl.	0.1-1	1-5	.....	....	.....	.....	.....	...
ct./bbl.	0.04-4	¶1.5-7.5	.....	....	.....	.....	*1.6-11	*3
Acid, cracked gaso.								
lb./bbl.	0.1-1	1-4	.....	....	.....	.....	.....	...
ct./bbl.	0.04-4	¶1.5-6	.....	....	.....	.....	*1.6-9	*4
Acid, cycle oil								
lb./bbl.	0.3-1	2-6	.....	....				
ct./bbl.	1.2-4	¶3-9	.....	....	.....	.....	5-12	7
Acid, kerosine								
lb./bbl.	0.5-2	2-10	.....	....				
ct./bbl.	2-8	¶3-15	.....	....	.....	.....	6-22	8
Methanol processes								
lb./1,000 bbl.	70-90	.....	§5-11	....				
ct./bbl.	0.28-0.36	.....	0.19-0.42	....	.....	.....	*0.5-0.7	*0.6
Solution promoter processes								
lb./1,000 bbl.	80-120	.....	.....	30-50	§1.5-2.5	.....	.....	....
ct./bbl.	0.3-0.5	.....	.....	0.3-0.6	0.14-0.22	0.1-0.15	*0.9-1.4	*1.0

*A precaustic wash (see Table 1) is used with most processes. The caustic quantities shown here do not include that for prewash.

†Delivered price for somewhat small shipments.

‡Can be made up from cheaper copper sulfate (1¢ ct./lb.) and hydrochloric acid (3 ct./lb.).

§Quantities and prices on a gallon basis.

¶Spent alkylation acid is worth much less than the 1.5 ct. used here.

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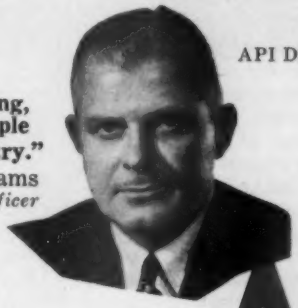

S.A.*

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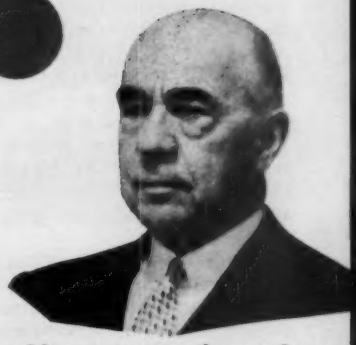

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Shell Oil Company

Sucker-rod pump: plunger travel

BY JOSEPH ZABA

THE PURPOSE of all surface and subsurface equipment of a beam-pumping installation is to impart the motion to the pump's plunger. As is the case with any other reciprocating pump, the displacement of a sucker-rod pump is a function of the plunger size, the stroke length, and the pumping speed. Pumping size and pumping speed are definite and controllable. So is the length of the surface stroke of the polished rod. However, even most general considerations, such as those in Part 3 of this series, suggest that there may be a considerable difference between the length of the polished-rod stroke and of the plunger stroke.

An attempt to find the actual plunger travel by theory is difficult because of many factors involved. These include stretching and contraction of rods and tubing resulting from imposition and release of loads during the pumping cycle, overtravel of plunger because of dynamic loads and resiliency of rods, the effects of rod vibration, subsurface friction, and gas in the pump barrel. The friction within the pump is hard if not impossible to determine. While the coefficients of friction of the plunger and pump components are known, the degree of the lubrication present is an unknown factor. Furthermore, abrasive matter quite often handled by the pump may increase the coefficient of friction to that above the value for perfectly dry surfaces.

On the upstroke the fluid load is transferred from the standing valve to the traveling valve. The rods must stretch before the upward motion of the plunger starts. At the same time the contraction of the tubing, with the release of loads, causes the pump barrel to move upward also, following the plunger. Thus, the relative motion of the plunger and the pump barrel is shortened by the sum of tubing and rod stretch. At slow pumping speed, 10 s.p.m. or less, this would be the primary factor affecting the plunger travel. At higher pumping speeds, however, the acceleration of the moving parts causes additional rod stretch which results in plunger overtravel.

With sucker rods considered an elastic system with one end fixed and the other vibrating with one degree of freedom, the plunger stroke becomes the amplitude of a forced vibration. This is the result of the effects of the disturbing force actually moving the plunger, the frequency of natural vibration of rods, and the damping forces present in the system. Recent analog studies of the sucker-rod system recognize the fact that a rod string is not an elongated spring with a weight suspended at the bottom, but that the weight and elasticity of rods are uniformly distributed through the whole string. We also know that there are three elastic columns involved: the rods, the tubing, and the fluid. These studies may furnish additional information on the actual travel of the plunger, which is of particular importance in view of the increasing pumping depth of wells.

At present, the formulas taking into consideration only the stretch of the rods and tubing and the overtravel of the plunger are most generally used in actual practice. However, some of the formulas which include the theories of vibration will be briefly mentioned as an interesting background of the subject.

Indications of plunger travel may be found in some dynamometer cards. Its magnitude may be determined from the subsurface dynagraph cards and from the wear of the pump barrel, when the pump is pulled.

Plunger Travel—Marsh-Coberly Formula

Harlan N. Marsh presented formulas for elongation of rods and tubing and C. J. Coberly the formula for plunger overtravel.[1,2] Actual plunger travel equals the polished-rod stroke less the elongation of rods and tubing plus the overtravel of the plunger.

The formula for the elongation of tubing:

$$S_T = 0.000000179\ (A_P - A_R) \times 1/A_T \times L^2 \times SG$$

The formula for the elongation of a straight string of rods is:

$$S_R = 0.000000179\ (A_P - A_R) \times 1/A_R \times L^2 \times SG$$

The formula for the elongation of the tapered string of rods is:

$$S_{RT} = 0.000000179\ (A_P - A_R) \times L \left(\frac{L_1}{A_{R1}} + \frac{L_2}{A_{R2}} + \frac{L_3}{A_{R3}}\right) \times SG$$

Where:

S_T = elongation of tubing, in.

S_R = elongation of straight rod string, in.

S_{RT} = elongation of tapered rod string, in.

A_P = area of plunger, sq. in.

A_R = area of rods, sq. in. (average for tapered string).

A_T = cross-sectional area of metal in tubing, sq. in.

L = depth of plunger, ft.

SG = specific gravity of pumped fluid.

L_1, L_2, L_3 = length of each rod size, ft.

A_{R1}, A_{R2}, A_{R3} = corresponding rod areas, sq. in.

Under assumption of simple harmonic motion, no reflected stresses, and no time lag in transmission of stresses through the sucker rods, the formula for overtravel of the plunger is:

$$e - e_1 = \frac{1.93\ (LN)^2}{1{,}000}$$

Where:

e = elongation of rods at bottom of stroke.

e_1 = elongation of rod at top of stroke.

$e - e_1$ = overtravel of plunger expressed as per cent of polished-rod stroke.

L = length of sucker rods in 1,000 ft.

N = s.p.m.

W. E. Gilbert showed, through actual measurements of the plunger stroke, that the factor of 1.93 of the formula varies from well to well.[3] In discussion of Gilbert's paper C. J. Coberly suggested an average value of 2.5.

Bibliography

1. Halan N. Marsh, "High Volumetric Efficiency in Oil Well Pumping and Its Practical Results": API Production Bulletin 207, 1931.

2. C. J. Coberly's discussion of the above paper, op. cit.

3. W. E. Gilbert, "An Oil Well Pump Dynagraph": Drilling and Production Practice, API 1936, p. 94.

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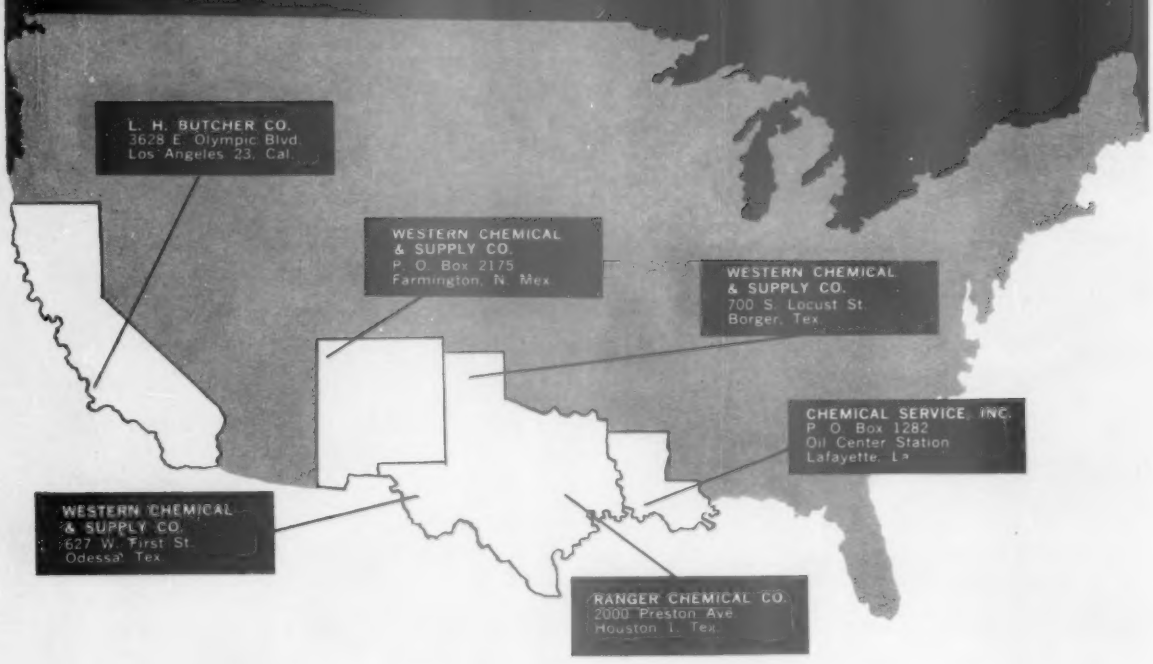

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EDITOR'S NOTE: In the opinion of The Journal's editors, this is probably the single most important article written about drilling in the past 5 years. The authors offer a sound basis for calculating the bit weights and rotary speeds which yield lowest possible cost. Their findings clear the last big hurdle that had prevented drilling from becoming a true science.

PART 1 OF 2 PARTS

How to calculate bit weight and rotary speed for lowest-cost drilling

BY E. M. GALLE AND H. B. WOODS
Hughes Tool Co., Houston

HERE ARE what we believe to be the best available empirical equations for the effects of weight, r.p.m., and tooth dullness on drilling rate, tooth wear, and bearing wear. These equations apply to many formations and drilling conditions.

From these equations we have developed usable methods to determine the way to vary weight and rotary speed for lowest drilling cost.

Field tests prove that large savings may be made by using the procedures recommended.

Briefly, this procedure shows:

1. With a carefully selected type of toothed bit, drilling fluid, and hydraulics program, weight and speed should be increased as the bit dulls. The proper variation of weight and speed depends on formation abrasiveness, drilling fluid, trip time, rig cost per hour, and bit cost.

2. With tungsten-carbide bits, weight and speed should remain constant during the bit run. The proper constant weight and speed depend on drilling fluid, trip time, rig cost per hour, and bit cost.

3. The graphs presented with this article may be used to find the correct variable weight and speed for toothed bits and the correct constant weight and speed for tungsten-carbide-studded bits.

Cost Studies

We have made theoretical cost studies to compare the variable weights and speeds with the best combination of constant weight and rotary speed. In most cases, the variable weight and rotary speed method would save at least 10%. We believe that the user should hope for a 10% saving in his drilling cost. Over-all percentage saving on four test wells was 20.9%, but comparisons were not always with bits run at best constant weight and rotary speeds.

We recommend that contractors compare their actual drilling cost with the theoretical minimum cost determined by the procedure outlined. If savings seem likely, experiment with the method on a complete well.

Limitation

There is a limitation on use of this procedure: Many rigs cannot vary rotary speed over a range without adversely affecting hydraulics. This procedure is also limited in that it cannot directly handle drilling conditions such as crooked hole, rough running or drill-stem vibrations, and bit life limited by gage wear.

When drilling very soft formations, bits with little tooth wear are often pulled because of bearing failure. In such cases, weight and rotary speed do not vary much by this procedure. Since we are not using an exact optimizing process when teeth wear very little, further investigations should be made on the exact optimizing process and also on whether it would be more practical to use constant weight and rotary speed in these very soft formations.

While we believe our empirical equations are the best available, a lot of guessing went into their formulation and they certainly can be improved. We hope that others will develop relations that will better represent the effects of weight, rotary speed, and tooth dullness on drilling rate, tooth wear, and bearing wear. May we repeat: the success of the procedure depends on the accuracy of these fundamental relations; if these relations are correct, the theoretical savings should actually be made in the field.

Many variables affect drilling costs. This paper discusses only two, weight and rotary speed. We assume proper attention is given bit selection, drilling fluid, and hydraulics. We also assume that crooked hole will not dictate maximum weight that may be applied and that rotary speed may be varied over a wide range without adversely affecting hydraulics.

This work combines the information obtained from the AAODC field tests with other information from laboratory and field tests. Object is to arrive at the way to vary weight and rotary speed during the bit run for drilling minimum-cost hole.

To find the most economical weight and rotary speed to run on a rock bit, it is necessary to know:

1. The relation between drilling rate and the factors that affect it.

2. The relation between rate of dulling of the cutting structure of the bit and the factors that affect it.

3. The relation between bearing-wear rate and the factors that affect it.

This paper is to show how such relations may be used to determine the way to run a bit for lowest drilling cost.

Cutting action of a rock bit is quite complicated. It is difficult to obtain accurate relations for the three items above. However, empirical formulas are developed from all the field and laboratory data at our disposal. These formulas closely approximate actual bit performance in certain types of drilling. These relations will certainly be improved as more field tests are made.

Drilling-rate equation. From practical experience we known that drilling rate is affected by weight, rotary speed, dullness of the bit, drilling fluid, hydraulics at the bit, and the forma-

Presented at 1960 annual meeting of AAODC, New Orleans, under title, "Variable Weight and Rotary Speed for Lowest Drilling Cost."

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tion. Field tests conducted by the Weight/Rotary Speed/Penetration Committee of the AAODC establish fairly reliable relations[1,2] for the effect of weight and rotary speed on drilling rate for certain formations.

It is too expensive to trip the bit several times during its life to determine dullness. Because of this, laboratory results[3] were used and modified to agree with field experience. The drilling-rate equation used in this work is:

$$dF/dT = C_f (W^k r/a^p)$$

where

k = 1.0 (for hard formations)
= 0.6 (for very soft formations)
p = 1.0 (for flat-crested bit-tooth wear)
= 0.5 (for self-sharpening or shipping-type bit-tooth wear)

(See notation-and-definitions section for explanation of other terms.)

In Equation 1, r is essentially rotary speed to a fractional power and a is a function of dullness. See Fig. 2 for sketches of these funtcions. Thus, drilling rate increases with drillability, weight, and rotary speed, and decreases with dullness.

In this equation the effects of bit type, hydraulics, drilling fluid, and formation are all included in the drillability constant C. Situations where the drilling rate response to increased weight changes rapidly, such as in a balling-up range, are not covered by this equation. However, this is somewhat approximated by the use of the 0.6 exponent on W.

Rate of dulling equation. From practical experience we know that the rate of dulling of a rock bit in a particular formation is affected by weight, rotary speed, and dullness of the bit.

It is difficult to determine the rate of dulling of a rock bit even under laboratory conditions. The teeth on different rows do not wear at the same rate and extremely accurate tooth-height measurements must be made at intervals to obtain consistent wear-rate values. Tooth chippage and breakage cause further complications. However, laboratory tests results[3] were modified to agree with actual bit performance in the field. Result is the following empirical equation:

$$dD/dT = (1/A_f)(i/am)$$

As seen in notation-and-definitions section and the sketches of Fig. 2, i is a quantity that increases with rotary speed, a increases with dullness, and m decreases with increase in weight. A_f decreases with increase of formation abrasiveness. Thus the rate of wear increases as abrasiveness, weight, and rotary speed increase, and decreases as dullness increases. In this equation the effects of bit type, hydraulics, drilling fluid, and formation are all included in the abrasiveness constant A_f.

Bearing-life equation. The life of a rock-bit bearing depends on capacity of the bit bearing, weight, and rotary speed run on the bit, and on drilling fluid in which it operates. While tooth dullness has some effect on bearing wear, field experience indicates it is negligible. Field and laboratory testing[4] result in the following equation for bearing life:

$$B = SL/N$$

The symbol L denotes a decreasing function with increasing weight. It is tabulated in Fig. 1 and sketched in Fig. 2.

The other quantities are explained in the notation and-definition section.

Denoting the fraction of bearing life expended by B_x, then in tume T:

$$B_x = T/B = TN/SL$$

This applies only if weight and rotary speed are constant during the time T.

If weight and rotary speed vary we may write

$$dB_x/dT = N/SL$$

provided we assume that the fraction of bearing life expended in each interval of time is independent of the weight and rotary speed at any other time before or after this interval. For example, if a bearing would last 10 hours at a particular weight and r.p.m., in 1 hour it would obviously be one-

Notation and Definitions

A = trip time + Bit cost ÷ Rig cost/hour, hours

A_f = formation-abrasiveness parameter

$A_n = A/A_f$

B = bit-bearing life, hours

B_x = fraction of bearing life expended

B_{xf} = final fraction of bearing life expended

C = drilling cost, rig-hours per foot

C_f = formation-drillability parameter

D = bit-tooth dullness, fraction of original tooth height worn away

D_f = final bit-tooth dullness

D_n = bit-tooth dullness at the nth increment in numerical work

F = distance drilled by bit, feet

F_f = final distance drilled by bit, feet

$$F_n = F/A_f C_f = \int_0^{D_n} (W^k\, rma^{1-p}/i)\,dD$$

H = hole or bit diameter, inches

$K = C \times C_f$

L = tabulated function of W used in bearing-life equation (See Fig. 1)

N = rotary speed, r.p.m.

N_f = final rotary speed, r.p.m.

S = drilling-fluid parameter

$$S_n = S/A_f = \int_0^{D_f} (Nam/Li)\,dD$$

T = rotating time, hours

T_f = final rotating time, hours

$$T_n = T/A_f = \int_0^{D_f} (am/i)dD$$

$$U = 714.19 \int_0^{D_f} adD$$

$$V = 714.19 \int_0^{D_f} a^{1/2}\,dD$$

W = bit weight, 1,000 lb.

W = equivalent 7⅞-in. bit weight = 7.88W/H

$a = 0.928125D^2 + 6.0\,D + 1$

b = N/L

d = i/**m**

$f_f = (1/A_f)(dT/dR) = am/i$

$f_2 = (1/A_f C_f)(dF/dD) = W^k rma^{1-p}/i$

$f_3 = (S/A_f)(dB_x/dD) = Nam/Li$

$i = N + 4.348 \times 10^{-5} N^3$

k = exponent on weight in drilling-rate equation

$m = 1359.1 - 714.19 \log_{10} W$

m = m/714.19

p = exponent on (a) in drilling-rate equation

$r = [e^{-100/N^2} N^{0.425} + 0.2N(1 - e^{-100/N^2})]$ (For hard formations)

$r = [e^{-100/N^2} N^{0.75} + 0.5N(1 - e^{-100/N^2})]$ (For soft formations)

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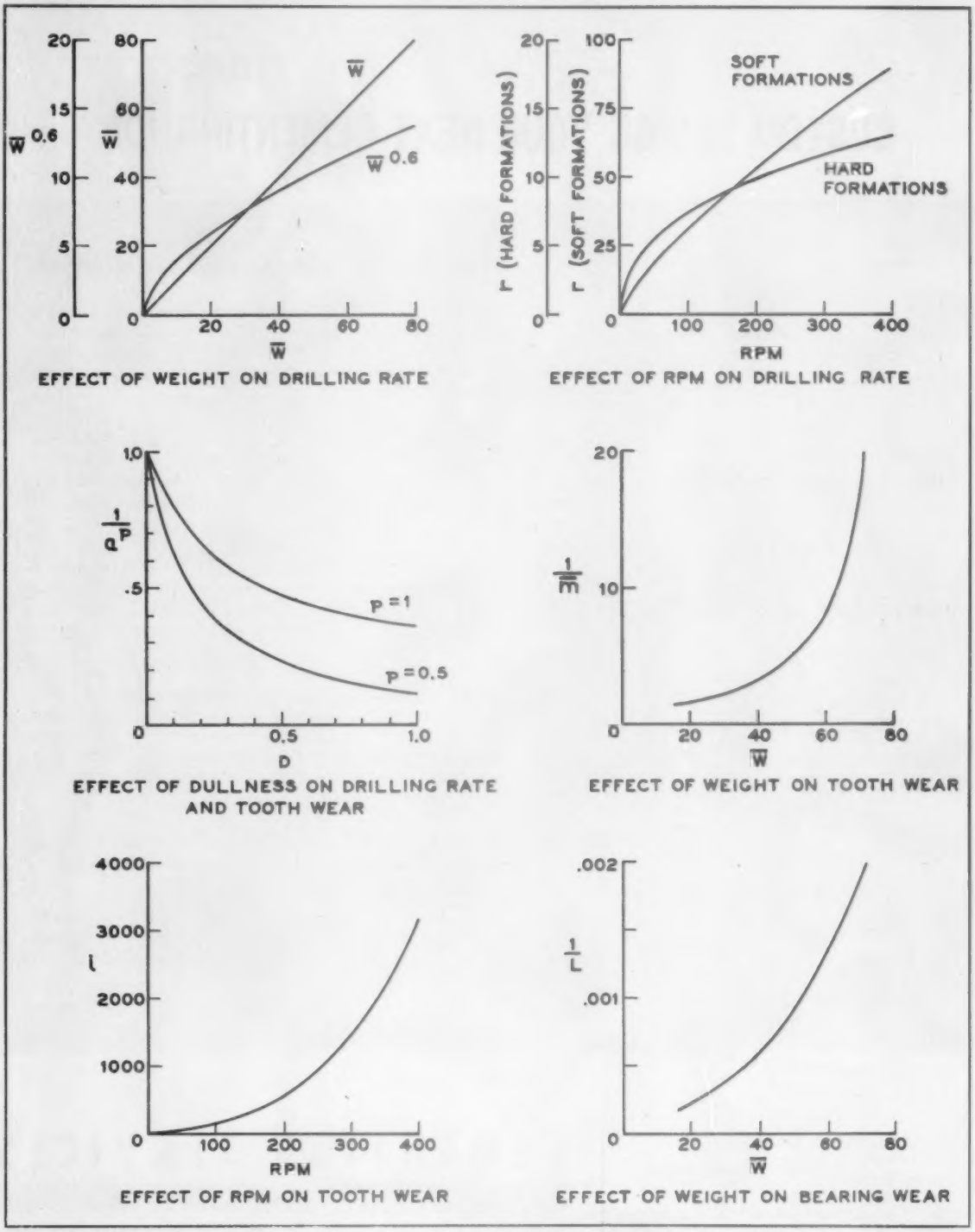
EFFECT OF WEIGHT ON DRILLING RATE
EFFECT OF RPM ON DRILLING RATE
SOFT FORMATIONS
HARD FORMATIONS
RPM
EFFECT OF DULLNESS ON DRILLING RATE AND TOOTH WEAR
p = 1
p = 0.5
EFFECT OF WEIGHT ON TOOTH WEAR
EFFECT OF RPM ON TOOTH WEAR
EFFECT OF WEIGHT ON BEARING WEAR

ROCK-BIT BEARING LIFE depends on weight and rotary speed and on the drilling fluid in which the bearing operates. The "L" symbol here is a decreasing function with increasing weight. (See Fig. 2 for a sketch of this relation.) Fig. 1.

tenth worn out. If it would last 5 hours at another weight and r.p.m., in 1 hour it would obviously be one-fifth worn out. We are assuming that if the bit were run 1 hour under each of these conditions, then it would be three-tenths worn out. While this assumption is not completely justifiable we believe that the errors resulting from it will be insignificant.

Bearing life decreases with increases in weight and rotary speed and increases with the drilling-fluid-factor S. Value of S for any given drilling fluid changes with different bits containing bearings of different capacity.

Field Results

Carefully controlled tests were run on four wells totaling 17,833 ft. of hole. The formations drilled ranged

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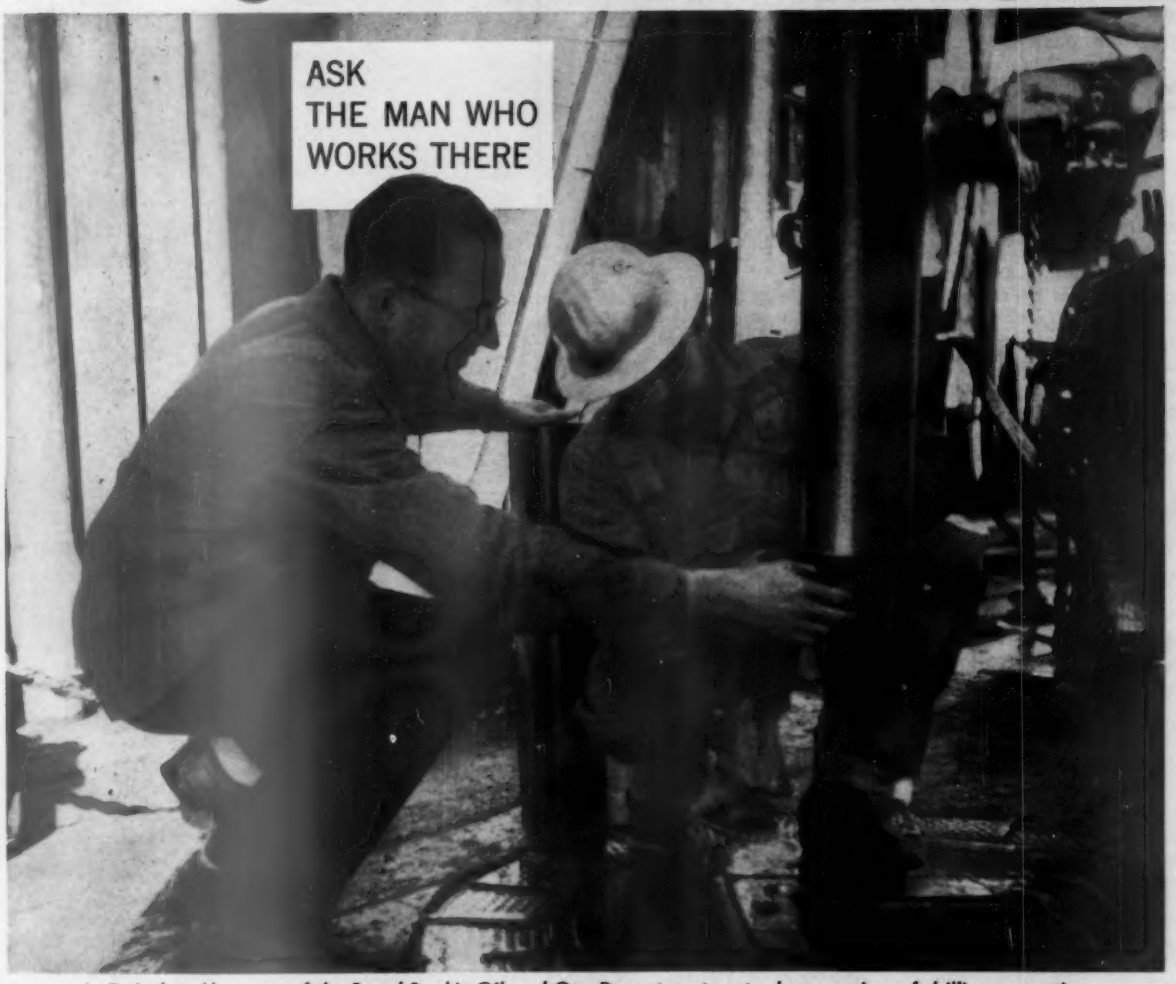

A. D. Insley, Manager of the Royal Bank's Oil and Gas Department, gets close up view of drilling operation.

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from very soft (150 ft. per hour) to very hard (4 ft. per hour) and included both homogeneous and very nonhomogeneous sections. Two of the wells were drilled in eastern Venezuela by Mene Grande Oil Co., while the remaining two were drilled in West Texas by Midland Exploration Co., and Sharp Drilling Co.

The tests were conducted in fields where data from wells drilled by the same contractor or operator were available for comparison.

Test No. 1. The first well drilled by the variable-weight and rotary-speed procedure was in the Zapatos-Zulus field of eastern Venezuela. This test was conducted during the early part of 1959 and covered depths from 10,460 to 13,405 ft. Weight and rotary-speed programs were calculated and these were followed fairly closely on most of ithe bit runs. Occasionally when the drilling rate was not as high as it was felt it should be, some experimentation was done to determine if a better combination of weight and r.p.m. could be found.

Weights used in this test were slightly higher and the rotary speeds were quite a bit lower than normal operating practice. It was felt that bit-gage wear was reduced by the lower r.p.m. Estimates of bit life were fairly accurate. Footage per bit and average drilling rate were increased.

Below is a comparison of the test well and a previously drilled well one location away.

	Test well A	Comparison well B
Total footage drilled	2,935	3,117
Number of bits	27	37
Footage per bit	108.7	84.3
Total rotating time, hours	309	456
Avg. drilling rate, feet per hour	9.5	6.8
Total cost, dollars	$61,570	$87,580
Avg. cost per foot	$20.95	$28.10

Per cent reduction in drilling cost 25.4%

Test No. 2. The second well was drilled in the Headlee field of West Texas by Midland Exploration Co., and covered depth intervals of 8,332-9,626 ft. and 9,810-11,832 ft.

In these tests it was necessary to use lighter weights than indicated by the calculations due to bit-pinching formations. This lighter-than-ideal weight was compensated somewhat by running slightly higher-than-optimum rotary speeds. Actually, the variation of bit weight on the test well was similar to that normally used by the contractor. The main difference on the test well was the wide variation in rotary speed compared to an essentially constant rotary speed used on the comparison well. Higher footage per bit was the outstanding difference in bit performance.

Below is a comparison of the test well and the nearest well drilled by the same contractor and crews.

	Test well HDU 45-5	Comparison well HDU 46-3
Total footage drilled	3,328	3,216
Number of bits	26	31.2
Footage per bit	128	103
Total rotating time hours	295½	290¾
Avg. drilling rate, feet per hour	11.3	11.1
Total cost, dollars	$23,271	$25,356
Avg. cost per foot	$6.99	$7.88

Per cent reduction in drilling cost: 11.3%

Test No. 3. The third well was drilled in the Zulus field of eastern Venezuela. In this test, 8,149 ft. of hole was drilled between the depths of 4,635 and 12,784 ft. Very good bit-performance records were available on a previously drilled well in this field and consisted of weight and rotary speed used each hour, pictures of the dull bits, bearing evaluations of the dull bits, and an electric log. The good records assisted greatly in using the variable weight and rotary speed method.

The theoretical weight and rotary speed programs were adhered to very closely on this test. In the lower portion of this well the formation was very nonhomogeneous and weights and rotary speeds were calculated on an expected average abrasiveness value for the section to be drilled. Footage per bit was increased on the test well.

Below is a comparison of the test well and a well one location away drilled by the operator.

	Test well C	Comparison well D
Total footage drilled	8,149	8,149
Number of bits	25	42.3
Footage per bit	326	192.6
Total rotating time, hours	328	351½
Avg. drilling rate, feet per hour	24.8	23.2
Total cost, dollars	$59,708	$79,596
Avg. cost per foot	$7.33	$9.77

Per cent reduction in drilling cost: 25.0%

Test No. 4. The fourth well was drilled in the Keystone field of West Texas by the Sharp Drilling Co. and covered the intervals 5,019-7,285 ft., 8,312-9,020 ft., and 9,353-9,800 ft.

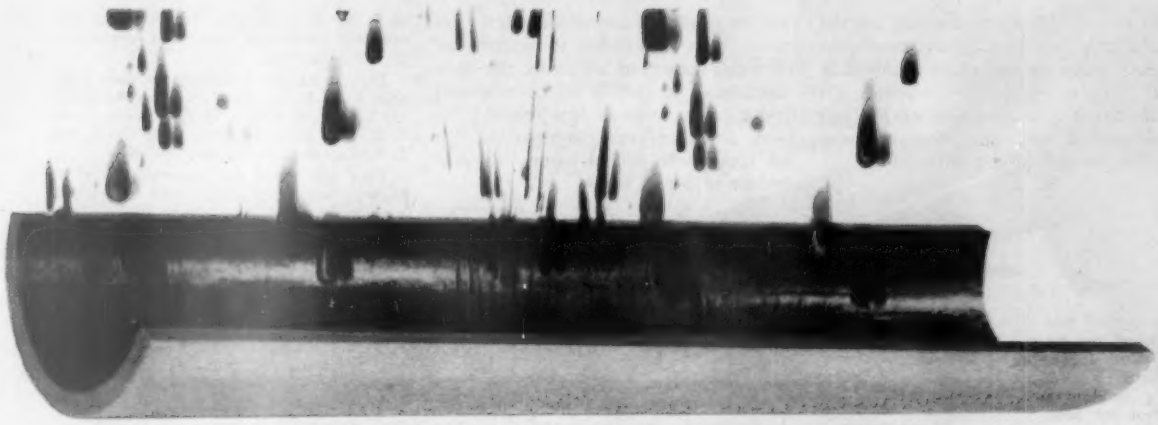
On most of the bit runs, the maximum calculated rotary speed to be run on the bit near the end of its life was as high as 150 r.p.m. In West Texas, experience has shown that long and large-diameter drill collar strings should not be rotated this high. Rotary speeds were limited to 70 r.p.m.

Lower than average weight and lower than average rotary speed were used on the test well and should have resulted in noticeably longer bit runs than on the comparison well, however, in many instances this was not the case. As a result less footage per bit and a slower drilling rate resulted. In

TABULATION OF L FUNCTION

W	L	L'
15	6240	-443.35
20	4439	-287.72
25	3270	-187.78
30	2496	-126.58
35	1963	- 89.37
40	1578	- 66.12
45	1288	- 50.68
50	1063	- 39.88
55	884	- 32.07
60	739	- 26.15
65	620	- 21.70
70	520	- 18.47
75	434	- 16.03
80	359	- 14.00
85	294	- 11.98
90	240	- 9.48
95	201	- 5.88

THE BASIC relationships that make it possible to calculate optimum bit weight and rotary speed are shown here. The relations involving dullness and tooth wear have only recently been established and have never before been published. Fig. 2.



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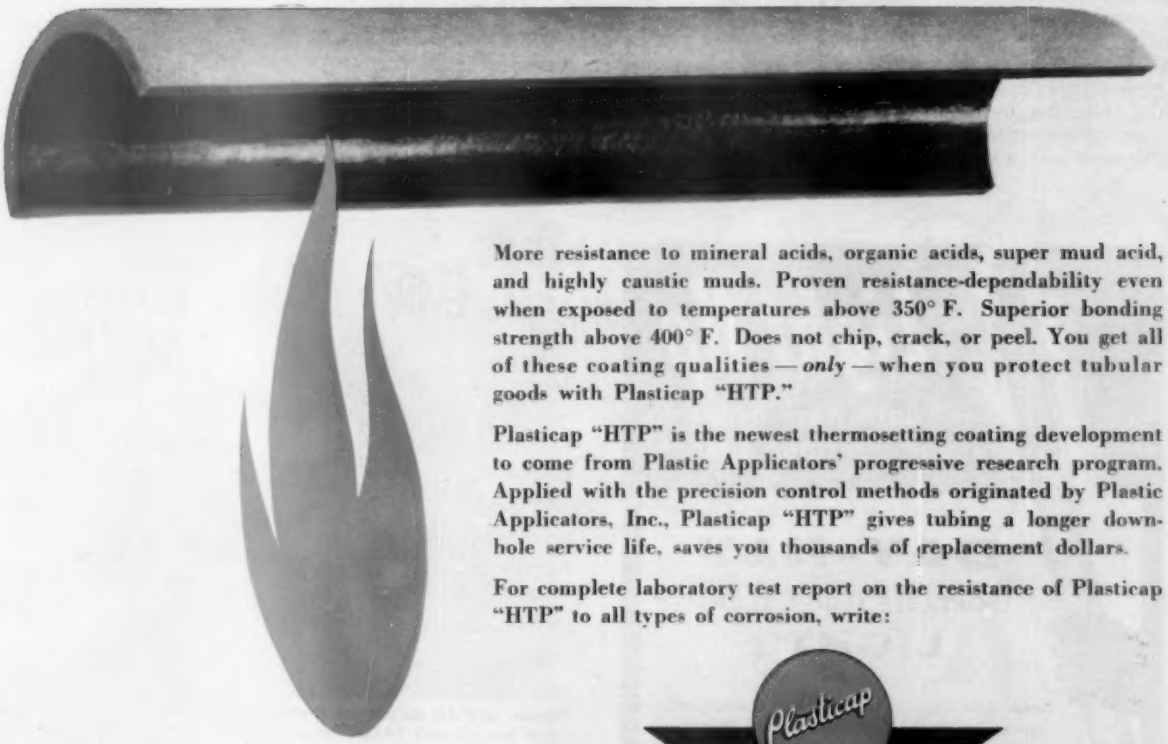

More resistance to mineral acids, organic acids, super mud acid, and highly caustic muds. Proven resistance-dependability even when exposed to temperatures above 350° F. Superior bonding strength above 400° F. Does not chip, crack, or peel. You get all of these coating qualities — *only* — when you protect tubular goods with Plasticap "HTP."

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only one of three test intervals did the variable weight and rotary-speed procedure show a reduction in drilling cost.

Below is a comparison of the test well and a well one location away drilled by the same contractor.

	Test well Campbell 29	Comparison well Campbell 30
Total footage drilled	3,421	3,601
Number of bits	22	22
Footage per bit	156	164
Total rotating time, hours	288	264¼
Avg. drilling rate, feet per hour	11.9	13.6
Total cost, dollars	$21,939	$21,030
Avg. cost per foot	$6.41	$5.84

Per cent increase in drilling cost: 9.8%

Summary toothed-bit tests. It is difficult to evaluate any drilling technique due to the multitude of factors that can affect bit performance. There is always some variation in the way the same formations drill, even when the distance between wells is only one location. Other things such as drilling-fluid properties, hydraulics, hole condition, drilling crew efficiency and equipment have a very decided effect on the results of any drilling test. Because it is impossible to control all of these factors at all times, the only recourse is to drill a lot of hole and compare the over-all test results.

A combined cost comparison for all four wells drilled using this procedure is shown below.

	Test wells	Comparison wells
Total footage drilled	17,833	18,083
Number of bits	100	132.5
Footage per bit	178.3	163.4
Total rotating time, hours	1,220.5	1,362.5
Avg. drilling rate, feet per hour	14.6	13.3
Total cost, dollars	$166,488	$213,562
Avg. cost per foot	$9.34	$11.81

This over-all comparison shows a 23.4% increase in footage per bit, and 8.9% increase in drilling rate, and a 20.9% reduction in drilling cost on the test wells.

Acknowledgment

The authors thank Mene Grande Oil Co., Midland Exploration Co., and Sharp Drilling Co. for their assistance in making the field tests. They are indebted to A. Brown, Rice University, for his help in the minimization problem and for preparing a rigorous derivation of the governing equations, and to T. M. Short, Hughes Tool Co., for successfully pioneering the field application of this procedure.

They thank the following for their valuable help: K. A. Blenkarn, Pan American Oil Co.; W. A. Kistler, M. C. Fisbeck, A. D. Wilkinson, A. L. Almoina, C. E. Cates, and J. R. Leatherman, Hughes Tool Co.

They also thank the many others in the industry who have contributed by encouragement, criticism, and faithful discussion.

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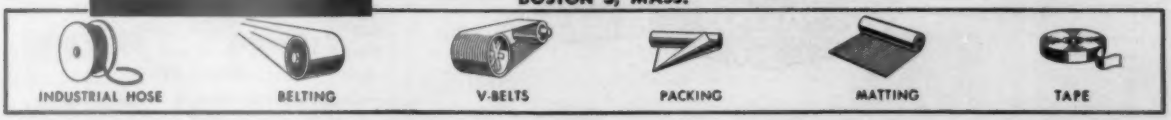
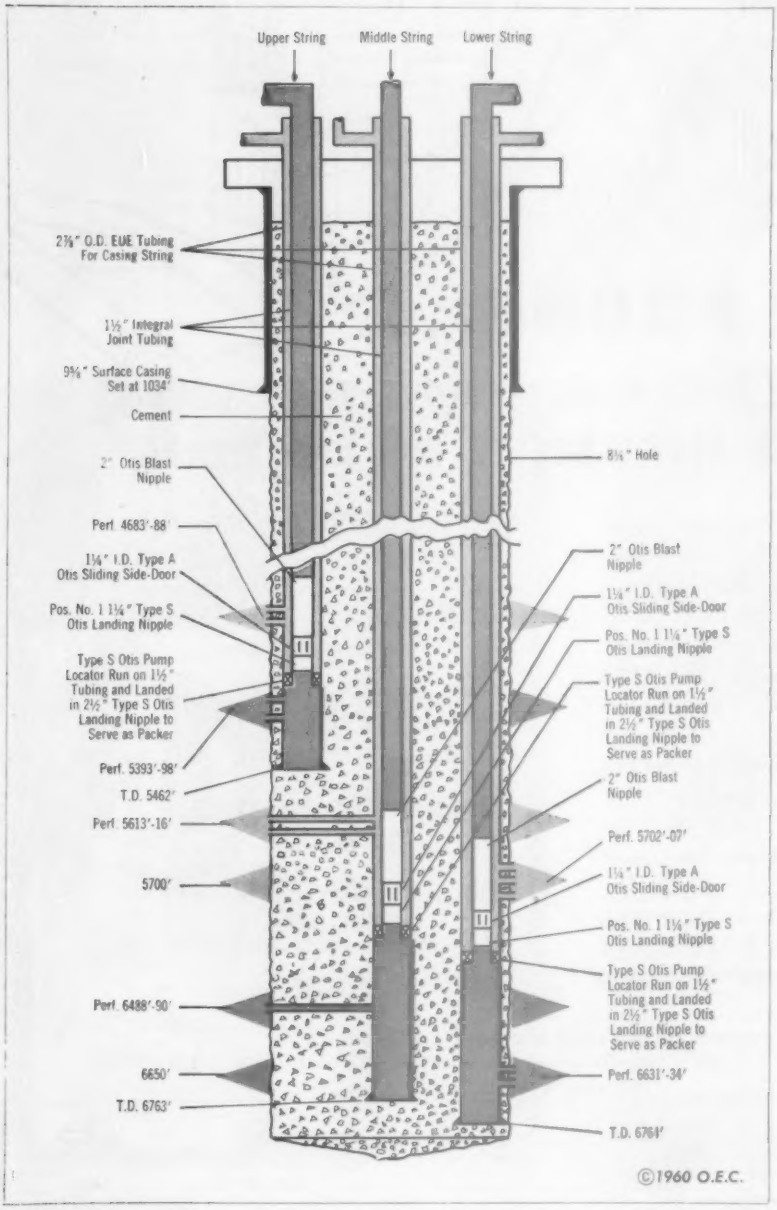


OTIS PRODUCTION NEWS

Volume I, Number 4 **Otis Engineering Corporation • Dallas** *Production Equipment and Services*

Otis Equipment Used Exclusively Below Tree in SUNRAY Sextuplet


Upper String
Middle String
Lower String
2⅞" O.D. EUE Tubing For Casing String
1½" Integral Joint Tubing
9⅝" Surface Casing Set at 1034'
Cement
2" Otis Blast Nipple
Perf. 4683'-88'
1¼" I.D. Type A Otis Sliding Side-Door
Pos. No. 1 1¼" Type S Otis Landing Nipple
Type S Otis Pump Locator Run on 1½" Tubing and Landed in 2½" Type S Otis Landing Nipple to Serve as Packer
Perf. 5393'-98'
T.D. 5462'
Perf. 5613'-16'
5700'
Perf. 6488'-90'
6650'
T.D. 6763'
8¾" Hole
2" Otis Blast Nipple
1¼" I.D. Type A Otis Sliding Side-Door
Pos. No. 1 1¼" Type S Otis Landing Nipple
Type S Otis Pump Locator Run on 1½" Tubing and Landed in 2½" Type S Otis Landing Nipple to Serve as Packer
2" Otis Blast Nipple
Perf. 5702'-07'
1¼" I.D. Type A Otis Sliding Side-Door
Pos. No. 1 1¼" Type S Otis Landing Nipple
Type S Otis Pump Locator Run on 1½" Tubing and Landed in 2½" Type S Otis Landing Nipple to Serve as Packer
Perf. 6631'-34'
T.D. 6764'
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CORPUS CHRISTI – Except for the tubing, all sub-surface production equipment used in the world's first sextuplet producer is standard Otis equipment. And the amount of Otis equipment used in this unique completion is surprisingly small in number and total cost; for example: Only two selective Type S Otis Landing Nipples, one Type S Otis Pump Locator which serves as a packer, one Type A Otis Sliding Side-Door®, and one Otis Blast Nipple were required for each two zones completed. The identical equipment was installed in each of the three strings of 2⅞-inch tubing to permit the six zones to be produced simultaneously and economically.

Otis is the only company which has available a complete range of small diameter sub-surface production equipment to help today's aggressive producing companies complete their slim hole and tubingless wells in the simplest manner. Otis Sub-surface Safety Valves, Sliding Side-Doors, Concentric Gas Lift Valves, Plugs, Plug Chokes, Pack-off Assemblies, and time proven wire line tools make it possible to complete as many zones as practical in the deeper, multi-zone wells being drilled today.

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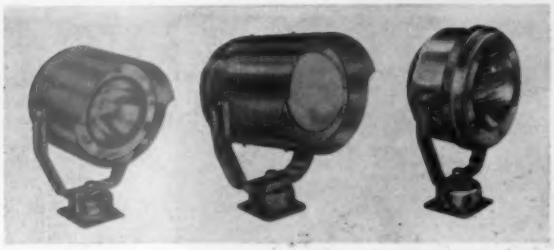
▶ ▶ ▶ New Equipment Section

This week's SHOWCASE features . . .

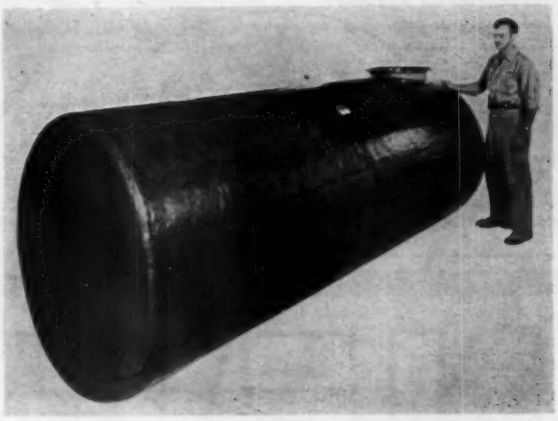
Floodlight withstands vibration



. . . and so provides 10 to 100 times longer bulb life than older types, according to the maker. Features cited for the Sturdilite floodlight include high-intensity illumination and controlled spread, hermetically sealed reflectors, and universal positioning. The light is reportedly fully weatherproof, wired, and supplied with a 4-ft. sealed cable. It comes in models for 6 to 120 volts. Source: **Phoenix Products Co., 4763 N. 27th, Milwaukee 9, Wis.**

Plastic tanks for corrosives

. . . can now be obtained in horizontal or vertical types made of glass-reinforced polyester for storing and processing corrosive liquids. The tanks come in capacities from 20 to 20,000 gal. They promise to replace stainless-steel or lined tanks in some applications where an increase in service life or decreased initial cost is desired. Source: **Justin Enterprises, Inc., 7000 Montgomery Pike, Cincinnati 36, Ohio.**



Flooded suction maintained easily

. . . on a trailer-mounted slush pump recently developed, the maker says. The unit operates with the trailer frame resting upon the ground. The low level of operation makes it simpler to maintain a flooded suction than is possible with conventional trailer mounting.

With the pump operating from a base upon the ground, the wheels are suspended in air. No jacks are needed. The suction hose runs under the axle unit at the rear of the trailer. When the trailer is winched onto a truck for hauling, the wheels return to roading position. Source: **Continental-Emsco Co., Box 359, Dallas, Tex.**

Penetrating lubricant

. . . has been announced which is said to be nonflammable, nontoxic, and harmless to the skin. The maker claims the product, called Moovit, makes the toughest dismantling job easy, and it safely and efficiently removes rusted and corroded parts. Source: **Lloyds Laboratories of America, 1317 Pine Ave., Niagara Falls, N. Y.**

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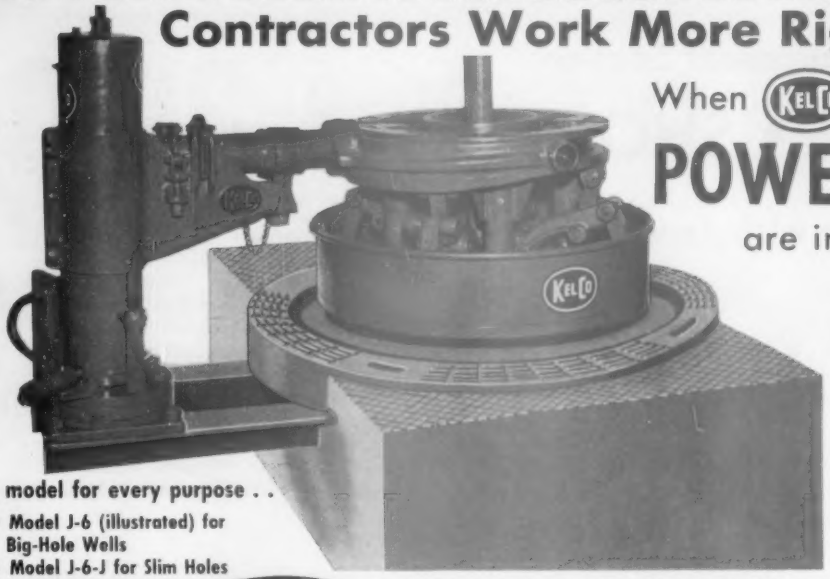

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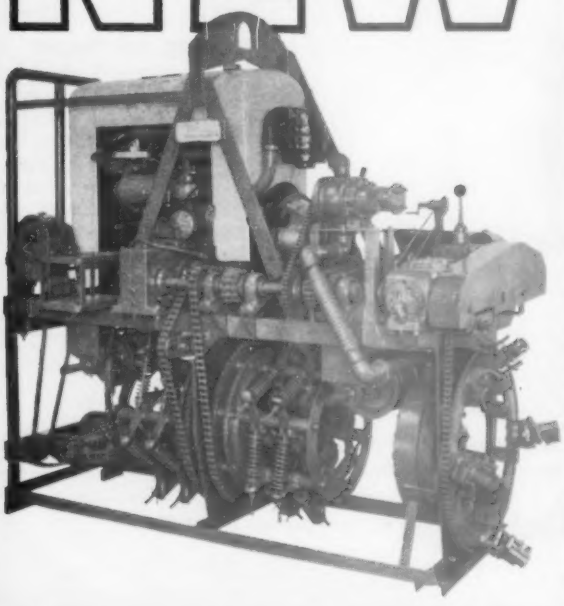
NEW



CROSE COMBINATION CLEANING & TAPE WRAPPING MACHINE

AVAILABLE IN FOUR MODELS

The New Crose Combination Cleaning and Tape Wrapping Machine has variable speed tape wrapping head; built-on blower to remove dust from pipe prior to applying tape, and baffles incorporated into machine's design to protect wrapping area from dust. Four models — comparable to the Crose Cleaning and Priming Machine — handle these pipe sizes: 2"-4"; 4"-16"; 16"-32" and 34"-40".

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Nonmetal pipeline marker

. . . posts and signs recently put on the market are made of an A.B.S. polymer resin-rubber compound and, according to the maker, are rustproof and rotproof. The maker claims that gun shots won't shatter them and that they never need painting as the finish is chemicallly bonded in.

The posts weigh 7½ lb. and are packaged five to the container. They may be equipped with side or top-mounted signs, mounted vertically or horizontally, with cathodic terminal cap, vent cap, and telephone tab. Fence climbers may also be added. A 5-in.-sq. foot piece anchors the posts in the ground. Source: **Handley Industries, Jackson, Mich.**

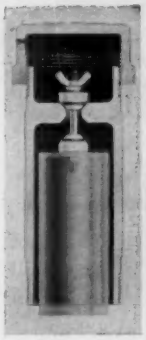
Spring-balanced loading assembly

. . . now available uses compression type of springs which are easily adjustable to meet varying loading conditions. The springs on the Model 460-M Oilco loader may be adjusted upright to 85°. The arm may be lowered to loading position without holding down manual pressure.

A companion product recently developed is a 6-in. boom type of loading arm that is designed to handle with the same ease as present 4-in. equipment. The assembly will be provided with a specially designed loading-line valve to eliminate shock and will be pilot controlled.

Still another companion product is an automatic loading-line valve, the Model 115, which provides vacuum control and predetermined shutoff, and permits operators to fill many compartments simultaneously. A fusible link is incorporated to help prevent fires. The valve may be shut off manually at any time. The valve comes in both 3 and 4-in. sizes. Source: **Oil Equipment Mfg. Co., Inc., 3100 Vermont Ave., Louisville 11, Ky.**

New overflow vent valve



. . . is on the market for water flood, salt-water disposal, and pumping wells. The valve has a cast-aluminum bronze body, lucite float, and teflon O-ring valves. The valve has been tested to 1,000 psi.

When it is desired to vent the casing on pumping wells, the vent valve acts as a safety valve. If fluid

THIS SOUTH LOUISIANA INSTALLATION was engineered and built by Moran to handle a high paraffin content crude. An unusual feature is pre-heating coils in the steam generator through which well head fluids pass before going to the separator to facilitate separation and treating.

Equipment includes a steam generator; high pressure separator; emulsion treater; and two storage tanks. Steam heating coils in the tanks reduce viscosity of the high pour-point crude. The entire installation operates unattended except for routine checks.

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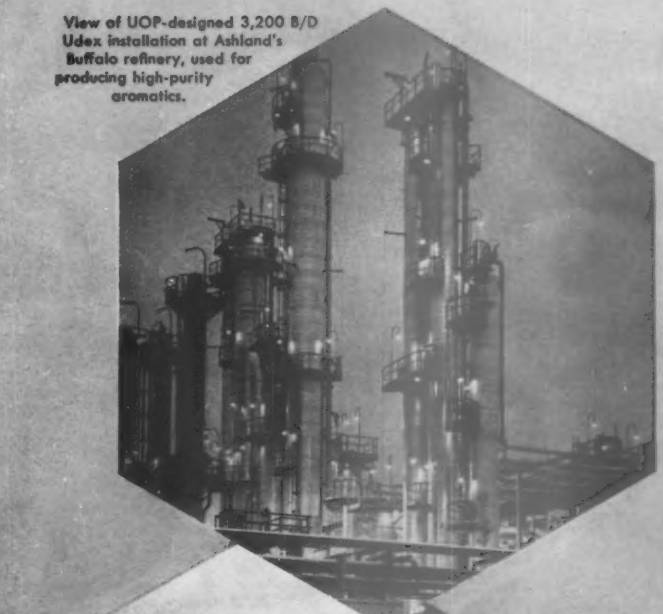
Udex® installation plays major role in Ashland's petrochemicals expansion program



View of UOP-designed 3,200 B/D Udex installation at Ashland's Buffalo refinery, used for producing high-purity aromatics.

UOP-designed units at Ashland's Canton, Ohio, refinery include Fluid Cat Cracking, gas concentration, Catalytic Polymerization, Visbreaking and vacuum distillation.

UOP processes contribute to Ashland's remarkable 36-year growth

By Robert E. Yancey,
Administrative Vice President
Ashland Oil & Refining Company
Ashland, Kentucky

R. E. Yancey

From a small 1,000 B/D skimming plant consisting of four shell stills in 1924, Ashland has grown to an operation utilizing six refineries with a total daily throughput in excess of 150,000 barrels of crude oil and an annual sales volume of $300,000,000.

Ashland serves the Ohio Valley and Great Lakes area through an efficient transportation network of crude oil lines, refined product lines, river towboats and barges, lake tankers, and trucks . . . Ashland branded products are sold through 3,500 service station outlets, and unbranded products through more than 1,000 independent distributors.

Udex, Hydeal*, and Naphthas Fractionating units provide expanded production of petrochemicals, jet and missile fuels

Our latest important expansion has taken place in the area of petrochemicals and other specialty products, such as aliphatic and aromatic solvents, special jet and missile fuels. Under this program a 3,200 B/D Udex unit for production of high-purity aromatics was placed on stream in May, 1958, at our Buffalo (N. Y.) refinery. Another UOP unit, now under construction at our Catlettsburg (Ky.) refinery will be the first commercial Hydeal process unit in operation for the production of benzene and naphthalene. Developed jointly by Ashland and Universal, this hydrodealkylation process will be used to produce benzene and naphthalene from low value heavy aromatics and alkylnaphthalenes. Benzene and naphthalene from the Udex and Hydeal units have numerous markets in the area of synthetic fibers, synthetic rubber, plastics, paints and other related fields.

Sales of petrochemicals and specialty products jump 44% in one year

Ashland's big push into the field of petrochemicals and specialty products proved extremely successful in 1959. Sales in these two areas jumped 44% in dollar volume over the previous year.

The importance of this new field of expansion was aptly phrased by Rexford S. Blazer, chairman of the board. "These sales . . . are highly profitable and demonstrate the value of the program of manufacturing diversification which the company will continue to expand. We place great emphasis on the production of tailor-made products for specialized uses throughout the great industrial area which can be served economically from our refineries and terminals."

Early facilities included Butane Isomerization and 'HF' Alkylation

Ashland's widespread activities are directed from the company's general headquarters located at Ashland, Kentucky, in the tri-state West Virginia-Ohio-Kentucky area. Catlettsburg, near Ashland, has been the site of Ashland's main refinery since the company's birth in 1924. The present corporation was formed in 1936 with the consolidation of Swiss Oil Corporation and Ashland Refining Company.

As sales increased, new units were added at Catlettsburg, many of UOP design. These included bubble tower fractionation (1925), an early single-coil Thermal Cracking unit (1926) later converted to two-coil, one of the first Catalytic Polymerization units for converting olefinic gases into high-octane gasoline, a combination crude atmospheric and vacuum distillation unit for the manufacture of asphalt and cylinder stocks (1938), a Butane Isomerization-'HF' Alkylation plant and catalytic cracking unit constructed during World War II for the production of aviation gasoline, and a 30,000 B/D fresh feed UOP Fluid Catalytic Cracking unit with gas concentration facilities added in 1956. Additional crude processing facilities were added in 1956 to increase the crude throughput to 80,000 B/D.

Company acquisitions add more process facilities and marketing outlets

Over the years, through the additions of various companies, Ashland now manufactures and markets a great variety of petroleum specialty products, many of which are sold in foreign markets. UOP processes and engineering services have been utilized extensively and to good advantage in all of our refineries. The Canton refinery, which has a crude capacity of 35,000 B/D utilizes many UOP-designed units, including Fluid Catalytic Cracking, gas concentration, Catalytic Polymerization, a Thermal Cracking unit later converted to Visbreaking, and a new vacuum distillation unit for the manufacture of asphalt.

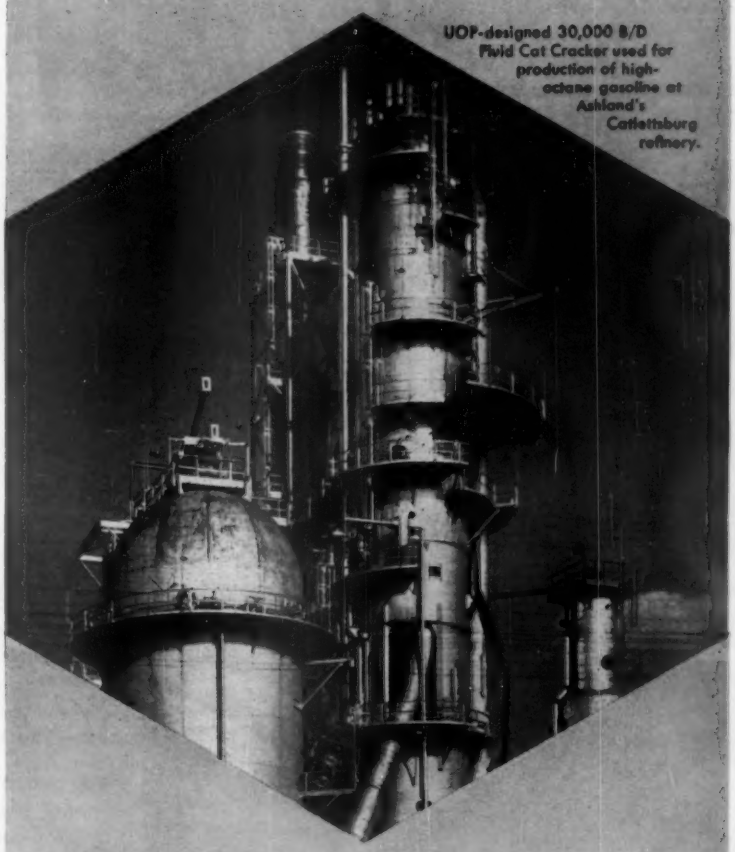
The Frontier refinery in Buffalo, N. Y., having a capacity of 32,000 B/D, is the site of Ashland's Udex installation which is an important cog in the company's petrochemical expansion program. A Hydeal unit is planned for this refinery. Additional UOP units at Frontier include Fluid Catalytic Cracking, gas concentration and polymerization. The addition of Frontier also provided Ashland with a number of valuable service station outlets and an extensive domestic fuel oil business. Asphalt is produced at Frontier as well as all of our refineries except the Valvoline plant, located at Freedom, Pa., which is primarily a lubricating oil refinery.

The purchase of R. J. Brown Company in 1956, and the Ohio-Indiana Division of Anderson-Prichard Oil Company in 1958, further strengthened Ashland's position as a refiner and marketer of industrial naphthas, solvents and petrochemicals. These two companies, along with the National Accounts Sales Department, market specialty products from our Udex and the new 8,400 B/D superfractionation units.

In November, 1959, Ashland obtained the modern refining facilities of the Louisville Refining Company, a large portion of whose processing installations were designed by UOP. Some of the more recent of these include facilities for the manufacture of asphalt, Fluid Catalytic Cracking, Unifining*, Platforming® and Merox*.

All of the six refineries now operated by Ashland have, at one time or another, installed units designed by UOP in cooperation with Ashland's engineering department. Practically all of our current expenditures are for facilities to make additional grades of profitable petroleum specialties, to upgrade the value of products from a barrel of crude oil, and to provide for more efficient and lower cost operations.

30,000 barrel-per-day Fluid Cat Cracker is a key process at Ashland's main refinery



UOP-designed 30,000 B/D Fluid Cat Cracker used for production of high-octane gasoline at Ashland's Catlettsburg refinery.

UOP

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ELIZABETH, NEW JERSEY

rises in the casing, the plastic float also rises. This causes a tight shutoff and prevents the loss of fluid around the wellhead, according to the maker.

When installed at high spots on long salt-water lines, the vent valve bleeds off the air to prevent air pockets which could restrict fluid flow. When used on disposal or injection wells, the vent valve constantly bleeds off air and gas from the input water. If well pressure drops below atmospheric pressure, the vent valve closes from the top side to prevent air from entering the well. Source: **Baird Mfg. Co., Box 380, Tulsa, Okla.**

•

New detector

. . . for combustible gas is reportedly 12 times as sensitive to vapors as older types. The Model SS detector detects every minute amounts of such combustible gases and toxic vapors as toluene and xylene. Potential uses include arson investigations and controlling quality by detecting small concentrations of organic vapors given off during processing.

Instrument is portable. Equipped with hose and probe for taking samples, the unit uses a rechargeable nickel-cadmium battery. Source: **Johnson-Williams, Inc., Palo Alto, Calif.**

GASOLINE GAUGING PASTE

Gives accurate gauges of light hydrocarbons (Butanes, gasoline, kerosene, crudes and jet fuels). Turns red on contact. Will not creep up gauge line.

WATER FINDING PASTE—

Turns red on contact with water level. Assures accurate gauges.

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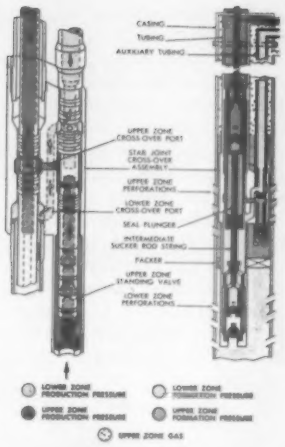

Two-zone oil-well pump

. . . recently introduced can be installed under the maker's 26½-ft. hydraulic pumping unit if maximum production is desired. Either a single or double upper-zone standing valve can be run on the auxiliary tubing. This short string of tubing is easily positioned and sealed automatically, the maker says.

The valves used are standard API cages. According to the maker, this design provides oversize standing valves for the upper zone pump.

A number of features are cited for the pump. The upper-zone standing valves can be retrieved without disturbing the packer, the main tubing string, and the upper and lower-zone pumps by removing the auxiliary tubing. The pump is available for two casing sizes: 5½ and 6⅝ in. Source: **Axelson Div. of U. S. Industries, Inc., 6160 S. Boyle, Los Angeles 58, Calif.**

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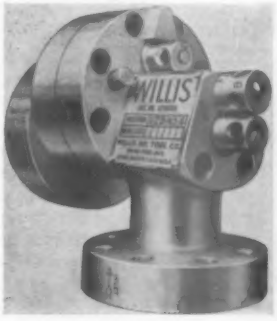
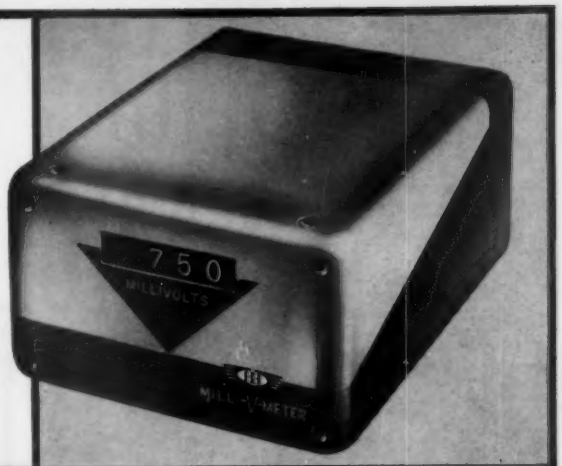


Rotary flow bean

. . . recently developed can be connected to the steel cross in a christmas-tree hookup to obtain adjustable flow control through a flow line, the maker says. Positive indexing to allow for increased or decreased flow is accomplished by rotating the orifice-carrying disk 60° to the next larger or

Only $285 per pound (proxl) —and They're real space savers, too.



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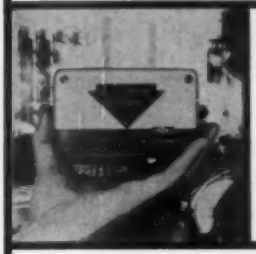

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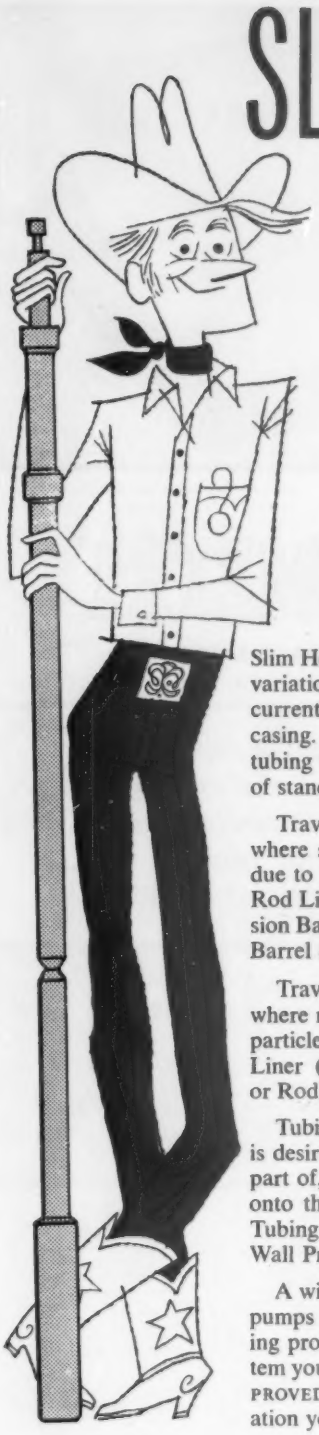

SLIM HOLE PUMPS

"Well-proved"

Slim Hole Completions are essentially scaled down variations of conventionally sized well bores. A current trend being the use of 2⅞" O. D. tubing as casing. A pump for these completions where small tubing is used is necessarily a scaled down version of standard A.P.I. type pumps.

Traveling Barrel Rod Pumps for installations where sand or solid particles cause pump to drag due to wedging. These pumps can be furnished as Rod Liner Traveling Barrel (R. L. T.), Rod Precision Barrel (R.W.T.) or Rod Heavy Wall Precision Barrel (R.H.T.).

Traveling Plunger Rod Pumps for installations where no difficulty is encountered by sand or solid particle. These pumps can be furnished as Rod Liner (R.L.B.), Rod Precision Barrel (R.W.B.) or Rod Heavy Wall Precision Barrel (R.H.B.).

Tubing pumps are used where maximum volume is desired. The barrel screws onto, and becomes a part of, the tubing string while the plunger screws onto the rods. These pumps can be furnished as Tubing Liner Pumps (T.L.E.) or Tubing Heavy Wall Precision Barrels (T.H.E.).

A wide variety of materials is available for these pumps to provide combinations to meet all producing problems. Regardless of the rod pumping system you should choose, installations of these WELL PROVED PUMPS will give you the trouble-free operation you desire.

WRITE FOR BULLETIN 206

DRESSER INDUSTRIES INC.

OIL · GAS · CHEMICAL ELECTRONIC · INDUSTRIAL

PACIFIC PUMPS

Inc. . . A Division of Dresser Industries, Inc.

HUNTINGTON PARK, CALIFORNIA

Mid-Continent:
1358 So. Sheridan Ave., Tulsa 12, Oklahoma
Pacific Pumps of Canada, Ltd.,
Edmonton, Alberta

smaller orifice position, the maker explains.

With a blank insert installed in one of the six orifice positions, you can obtain positive shutoff by revolving the orifice-carrying disk so the blank orifice is in the line of flow, the maker says. This design is said to eliminate the need for a wing valve in the hookup which can provide a simpler and more compact christmas-tree assembly. The Type L flow bean comes with either screwed or flanged connections for 1 to 3-in. flow hookups. Source: **Willis Oil Tool Co., 2451 Palm Dr., Long Beach 7, Calif.**

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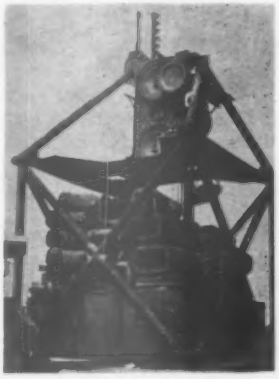


Electric elevator

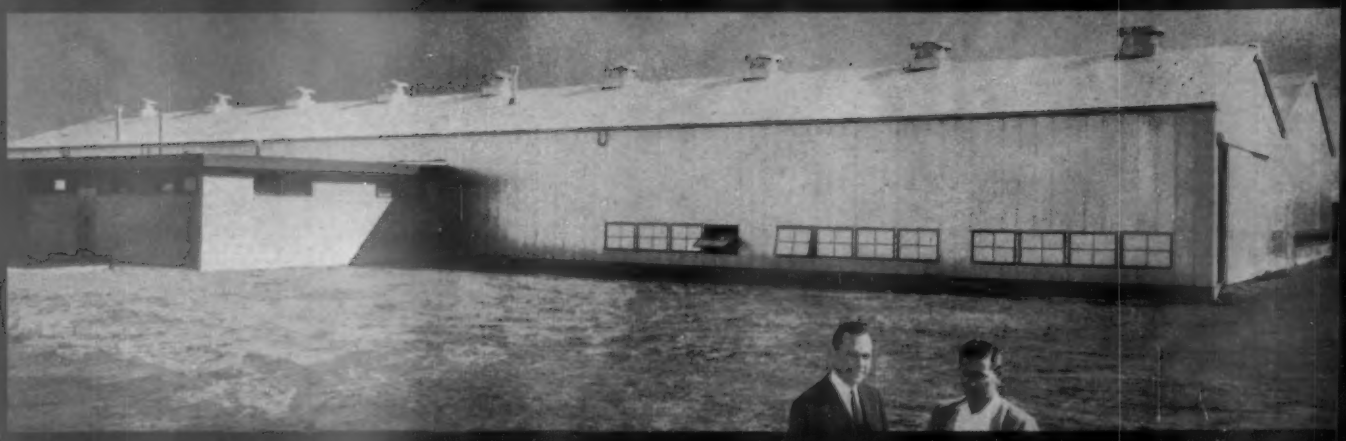
. . . has been developed to raise and lower mobile offshore drilling platforms built by the maker. The 1,000-ton size elevator contains three a.c. motors and gear reducers. By adding more gear motors, the lifting capacity can be increased further. Source: **R. G. LeTourneau, Inc., 2399 S. MacArthur, Longview, Tex.**

•

Vibration meter

. . . is available. By comparative readings over time periods, you can establish bearing wear. The portable battery-operated meter is transistorized. The maker says it is self-contained and indicates peak amplitudes of both absolute and relative vibrations directly on the meter dial.

Readings are in microns. Frequency range is 5 to 1,200 c.p.s. Measuring range is from 0 to 1,000 μ value (0.039 in.) in five steps. Sensitivity is reported to be down to 0-12 μ full scale. Weight is 5 lb. Measurements are 9 by 5 by 4 in. Source: **Korfund Co., Inc., Cantiague Road, Westbury, N. Y.**



Left to right, Joe H. Williams, Tube-Kote's Canadian Plant Manager and Mack E. Dunny, Plant Supervisor are shown in front of the new Tube-Kote Plant in Edmonton, Alberta, Canada.

ANNOUNCES

NEW CANADIAN PIPE COATING PLANT

Tube-Kote, Inc.'s new plant is designed to help solve paraffin and corrosion problems of Canadian oil and gas production. It occupies an 8½ acre plot in the Cornet addition of Southeast Edmonton. The plant is the newest, most modern, fully automated facility to be found for coating oil field tubular goods with baked-on plastic coatings.

CASE HISTORIES ON REQUEST

Let a Tube-Kote representative show you actual case histories proving the economy of applying the Tube-Kote coatings to your oil field tubular needs. Tube-Kote can save you money when you are faced with paraffin control and corrosion problems.

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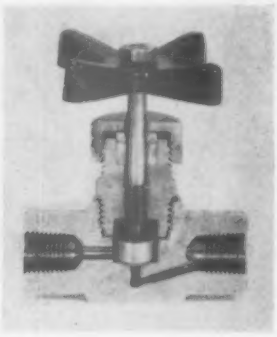
V-type quadruple pump

. . . a plunger type recently developed, is designed to handle fluids with viscosities up to 30,000 S.s.U. at normal operating speed as well as light hydrocarbon fluids.

The V-60 pump comes in ratings from 150 to 1,250 hp., capacities from 100 to 1,300 g.p.m., in five frame sizes, and with eight models trimmed for any type of service.

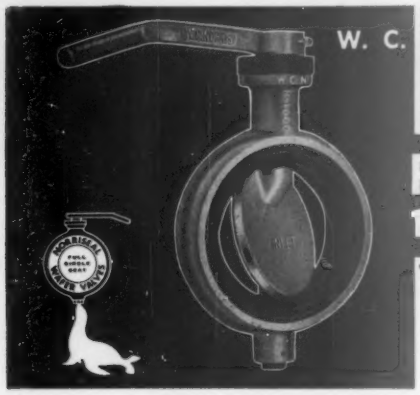
The pump is expected to prove useful for service in drilling, hydraulic fracturing, water flooding, crude-oil pumping, light hydrocarbon pumping, and petrochemical-product pumping.

Pump features include compact construction due to the V-type design, replaceable packing cartridges, direct drive, individual valve pots with cylinder heads and valves, and threaded valve covers for ready access. Source: **Barry Pump Co., Box 2238, Tulsa, Okla.**



High-pressure shutoff valve

. . . is on the market with a body made of Type 303 stainless-steel bar stock, a monel stem and gasket, and Teflon seat and stem seal. It promises to prove useful for corrosive fluids and gases. The stem tip is a free-turning metal cage enclosing a fitted Teflon seat which, the maker claims, eliminates galling and abrasion of the seat regardless of the number of times the valve is opened and closed. The valve comes in ¼ and ½-in. pipe sizes. Source: **Clayton Mark & Co., Dodge & Dempster Sts., Evanston, Ill.**



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150 psi working pressure

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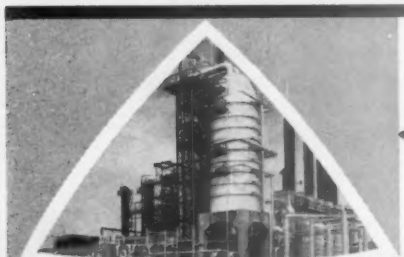
VALVES



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BUY WORTHINGTON PUMPS LOCALLY IN 235 CITIES

Take a look in your Yellow Pages under "pumps" and see. Chances are overwhelming that you'll find a Worthington dealer there, and only a local call away. We have over 235 distributors covering nearly every trading area in the country.

So what's your advantage? One is that if you standardize on Worthington standard pumps, for locations coast-to-coast, Worthington can be a local supplier to every installation. Another is that you're dealing locally, face-to-face with men who are willing to be held responsible—and who will be there when needed.

Extremely important—you get very quick service. Remember, over 200 of these distributors stock parts—seals, bearings, packing, impellers—the kind of parts that handle 19 out of 20 emergencies. And many stock a variety of commonly used pumps.

Perhaps, however, what's of most interest to you is the seven regional Worthington assembly points. They're all F.O.B. points—even the furthest plant from a Worthington assembly point pays less than 800 miles freight . . . and you're probably much closer. From any one of these locations we can deliver more models than most other manufacturers build all together.

If you don't know who your Worthington distributor is right now—take a quick look in the Yellow Pages. We think you'll like the service you get. Worthington Corporation, Section 20-20, Harrison, N. J.

WORTHINGTON

CM2-RC

CMI-BK

MACCO

MACCO RETRIEVABLE CM2-RC INTERMITTING OR CONTINUOUS FLOW VALVE

The CM2-RC is the basic CM2 conventional valve with integral reverse flow check valve. This valve is selectively retrievable from MM series Sidepocket Mandrels. For continuous flow operations, graduated port sizes of valve seats govern gas passage of the valves.

For further information, write for Retrievable Valve Brochure No. 9-01.

MACCO RETRIEVABLE CM1-BK INTERMITTING OR CONTINUOUS FLOW VALVE

The CM1-BK is the basic CM1 conventional valve with integral reverse flow check valve. This is selectively retrievable from K-B and K-C series Sidepocket Mandrels. The CM1-BK valve was designed with particular emphasis on "slim hole" installations. Continuous flow valves are equipped with graduated port sizes as required.

For further information, write for Retrievable Valve Brochure No. 9-01.

MACCO equipment is also available in sterling areas from Williams & James (Oil Tools) Ltd., Gloucester, England.

MACCO OIL TOOL COMPANY, INC.

1521 Prince P. O. Box 7288 Houston 8, Texas

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More equipment manufacturers choose Fast's Couplings than any other gear-type coupling

Leaving other claims aside, the thing that counts in couplings is customer confidence—and industrial equipment manufacturers have made Fast's their overwhelming choice. The Fast's line is more diversified, too—in a complete range of sizes and types for shafts, from ½" to 32" and larger.

Every Fast's Coupling brings you superb engineering only the original gear-type coupling can deliver. Smooth-running units that are designed to outlast the machines they connect. Rapid service from experienced field engineers backed by outstanding stock facilities. Write today for full details on couplings to suit your needs to: KOPPERS COMPANY, INC., Fast's Coupling Dept., 1411 Scott St., Baltimore 3, Maryland.

KOPPERS

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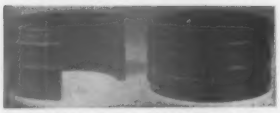

Nonadjustable plunger packing

. . . for well-servicing pumps used in acidizing, cementing, and sand fracturing is claimed to be noncrushable. The maker reports the product has performed satisfactorily in field tests on well-servicing pumps equipped with a lubrication system using steam cylinder oil. The Style 842 packing is available for all plunger pumps in well-service use. Source: **Universal Packing & Gasket Co., 5200 Clinton Dr., Houston 20, Tex.**

•

Descaler

. . . won't corrode metal while dissolving scale, according to the maker of a new product called Scale-Cleen. As described by the maker, the product is made with sulfamic acid and inhibitors that allow the acid to clean and dissolve scale without corroding or damaging metal. A "built-in" color indicator shows when the acid has been spent. Source: **Dearborn Chemical Co., Merchandise Mart Plaza, Chicago 54, Ill.**

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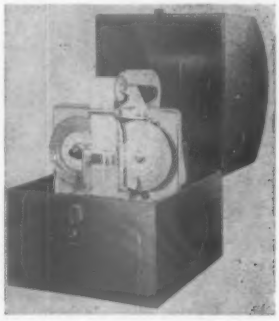

Gas survey recorder

. . . developed for use with a conventional gas meter to make time-demand studies of gas consumption. The recorder produces a punched tape record of gas demand that can, according to the maker, be automatically translated to punched cards or to computer tape for computer studies.

The recorder can be coupled to any gas meter by means of a contact-making device within the meter, says the maker. The recorder then maintains a running total of gas used and records the total on a binary-coded paper tape every 15, 30, or 60 minutes. Source: **Fischer & Porter Co., 669 Jacksonville Rd., Warminster, Pa.**

Rigid Poly-Urethane Foam "Sprayed in Place"

JUST INSTALLED for large chemical company in New Jersey—largest U. S. storage tank installation of poly-urethane foam using "sprayed in place" technique.

Two one-half million gallon dome-roof tanks now have this superior protection. "Sprayed in place" poly-urethane foam may be the best answer to your insulation problem.

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seals casing couplings, refinery fittings, 7 ways better!

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Completely insoluble and inert to chemicals, alkalies, and acids . . . will not leach out and foul up systems ■ Unaffected by temperatures —250° to +500° F ■ Lubricates as it seals . . . completely eliminates thread-galling even on stainless steel ■ Withstands high pressures and vibration ■ Faster, easier to apply . . . wrap once around connection, tear off, that's all ■ Never hardens . . . disassemble with ease, anytime ■ In widths of ½", ¾", 1", 4" and wider.

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Friesland, Wisconsin

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Sand Resistant ROD PUMPS

Top Hold Down Insert Rod Pump
Standard Size, Figs. 400T, 500T

Self-aligning double plunger insert pumps. Made in three types: combination cup and single plunger; combination cup and double self-aligning type; and metal-to-metal double plunger self-aligning type. All are equipped with Regular or Extra Long Alloy Plungers, ground individually to fit the barrels, assuring longer life on both pump and surface equipment.

Traveling Plunger Rod Type

Bottom Hold-down Pump
Standard Size, Figs. 400P, 600P, 700P, 800P

Single or double, self-aligning, combination cup and plunger or all-metal traveling plunger type, rod pumps made in four sizes: regular 1½", 1⅝" oversize, 2" regular and 2⅛" oversize bore. These pumps seat in API seating nipples.

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Thompson PUMP COMPANY
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We bet millions on our couplings

When you buy a Fast's coupling, you can bet your bottom dollar everything was built on the spot, not assembled piece by piece from other suppliers. Koppers multi-million dollar manufacturing facilities are the most modern in the industry . . . with advanced program machines, highly accurate gear shapers, a complete forge shop.

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KOPPERS COMPANY, INC., 1411 Scott Street, Baltimore 3, Md.

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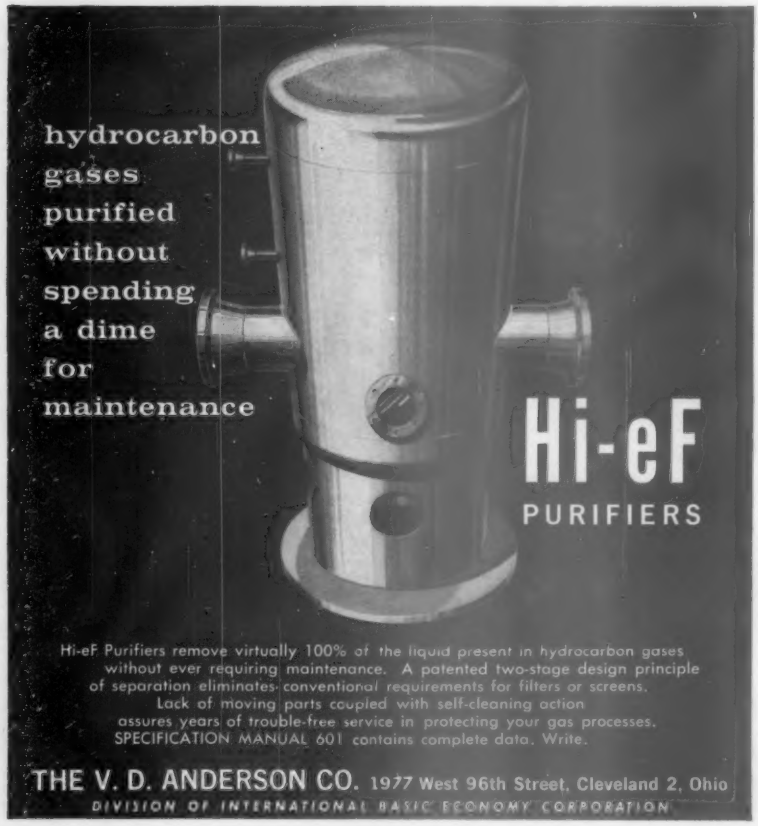


Hi-eF Purifiers remove virtually 100% of the liquid present in hydrocarbon gases without ever requiring maintenance. A patented two-stage design principle of separation eliminates conventional requirements for filters or screens. Lack of moving parts coupled with self-cleaning action assures years of trouble-free service in protecting your gas processes. SPECIFICATION MANUAL 601 contains complete data. Write.

THE V. D. ANDERSON CO. 1977 West 96th Street, Cleveland 2, Ohio
DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION

SHOWCASE . . .

New Literature

Map racks

. . . are said to provide neat and orderly storage for large maps, drawings, blueprints, etc. A six-page literature piece includes dimensions, capacities, and shipping weights of the racks. Source: **Frontier Mfg. Co., 11200 Harry Hines Blvd., Dallas, Tex.**

Liquid-slurry

. . . gas-contacting mixers are detailed in an eight-page brochure. The mixers are designed and built on the "building block" concept, which allows complete interchangeability of the basic components. The brochure offers descriptions and sufficient technical data to permit preliminary selection. Typical installations are illustrated along with related mixing equipment. Source: **Cleveland Mixer Co., Box 197, Bedford, Ohio.**

Back-up-ring

. . . booklet gives design, dimensions, and other data on Parbaks—continuous and contoured back-up rings. Eight-page Booklet 5482 describes the characteristics of back-up rings and discusses the advantages of contoured and continuous rings. Included are dimensions and operating media data. Source: **Parker Seal Co., 10567 Jefferson Blvd., Culver City, Calif.**

Radioisotopes reprint

. . . obtainable now for the asking, tells how a measurement and control system using radioisotopes solves tough process problems presented by corrosion, high viscosity, large solids content, and sticky slurries, without drastic and expensive alterations. Source: **Ohmart Corp., 2236 Bogen St., Cincinnati 22, Ohio.**

Super alloy tubing

. . . selection guide explains how resistance to high temperatures makes the tubing an invaluable engineering material in such applications as hot-gas generators, hot-gas ducts, hot-gas transfer tubes, hydraulic lines, and engine mounts. Of particular value in the 16-page revised bulletin is creep-rupture data for each of the eight superalloys. Presented in bar graphs, the data covers 100-hour tests carried out, and 1,000-hour tests gathered from previous published sources. A writeup of the test procedures is included along with a photograph of

D. I. S. STRIPS 10-INCH SCALE FROM 12-INCH PIPELINE IN JUST ONE DAY!

Dense scale deposits of oxides, sulfides and sulphur—10 inches thick in some places—clogged a 12-inch fuel supply line. Dow Industrial Service engineers stripped every trace of deposits from this 750-foot pipeline—restoring full capacity—in *just 24 hours!*

Solvents and a pipeline pig did the job. But for different conditions, D. I. S. uses other techniques to get the same result. For example, when scale blocked a 24-inch, quarter-mile-long waste line, D. I. S. engineers knocked out the deposits with a special D. I. S.-designed jet mole. Though this underground pipeline was buried 10 feet deep, D. I. S. cleaned it completely in only 16 hours!

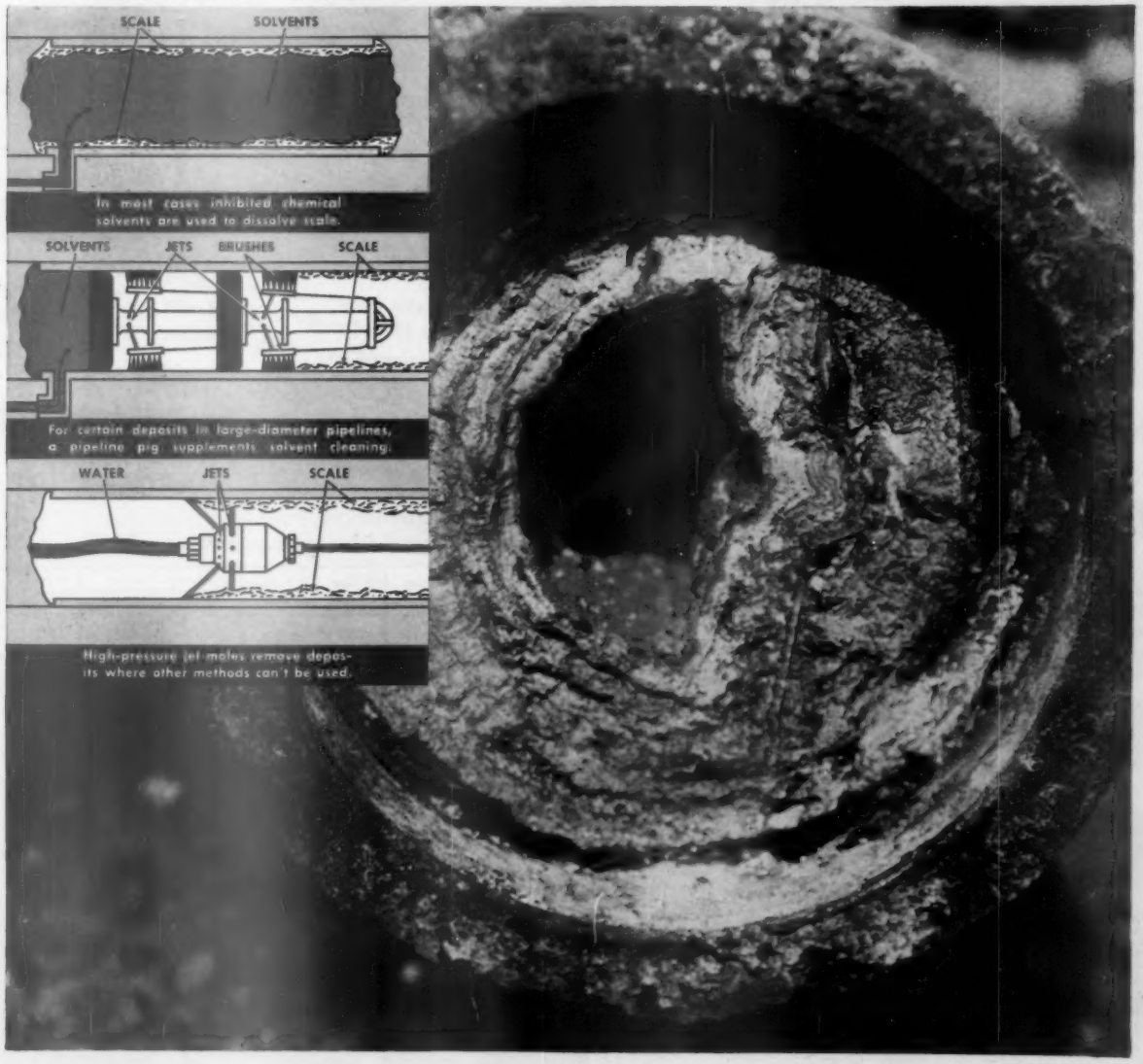
Nation-wide Dow Industrial Service first analyzes the job to be done, then selects the technique which will do the best job, fastest. D.I.S. cleans all kinds of lines—fresh water, boiler feed-water, gas, waste and other lines—and every kind of process and heat exchange equipment.

In addition, D. I. S. offers complete consulting laboratory service for water treatment and waste processing problems, backed by the technical resources of The Dow Chemical Company. For cleaning *any kind* of equipment, *anywhere* in the U. S., write or call DOW INDUSTRIAL SERVICE, 20575 Center Ridge Road, Cleveland 16, Ohio.

Dow

DOW INDUSTRIAL SERVICE • Division of The Dow Chemical Company

From these three methods, D. I. S. selects the one best suited to your specific pipe-cleaning problem.



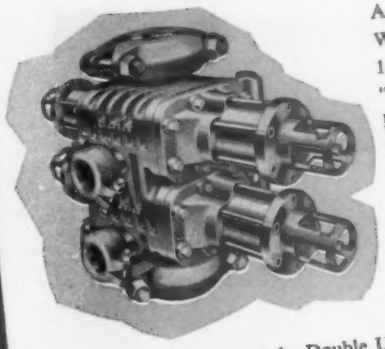
LATEST SHAFFER "LWS" ADVANCEMENTS MARK NEW ERA IN BLOWOUT PREVENTERS

With modern drilling programs constantly probing into more and more remote areas of the globe, it was inevitable that blowout preventer equipment would eventually become lighter in weight, easier to handle and transport—*without sacrificing pressure handling abilities or basic operating features.*

Shaffer, pioneer in pressure-control equipment, recognized this need several years ago and initiated a major research and development program in lightweight control gate designs. This program led to development of the initial Shaffer "LWS" Preventers—units that offered adequate pressure protection for production and re-work applications, yet weighed approximately one-half as much as comparable equipment then available.

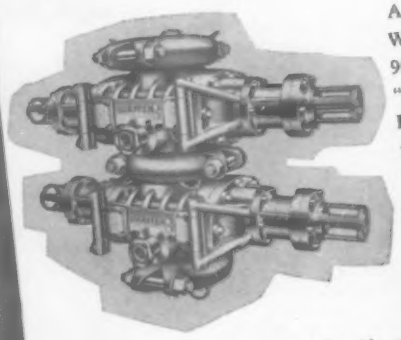
Now Shaffer has taken another major step ahead of the field with announcement of these two additional "LWS" Preventers having even higher pressure ranges than the original "LWS" units, coupled with important savings in weight that assure lower transportation costs and greater handling ease . . .

6"—5,000# W. P.



A new 6"—5,000# W.P. (6" Series 1500) Shaffer Type "LWS" Hydraulic Blowout Preventer with a *Working* Pressure of 5,000 PSI (*Test* Pressure of 10,000 PSI) and a 7-1/16" Bore. This unit is available in both *Single* and *Double* designs—and the Double Unit has a total weight of only 2,610 lbs. (as compared with the 5,700 lb. weight of comparable equipment heretofore available). *That's a saving of 55% in weight—with no sacrifice in operating features!*

10"—3,000# W. P.



A new 10"—3,000# W.P. (10" Series 900) Shaffer Type "LWS" Hydraulic Blowout Preventer with a *Working* Pressure of 3,000 PSI (*Test* Pressure of 6,000 PSI) and an 11" Bore. This unit, also, is available in both *Single* and *Double* designs—and the Double unit has a total weight of only 3,850 lbs. (as compared with the 6,965 lb. weight of comparable equipment heretofore available). *That's a saving of 45% in weight!*

All the above "LWS" Preventers incorporate the latest Shaffer advancements . . . **Swinging END-Opening Doors** for quick, simple ram changes without loss of operating fluid—**Positive Direct Hydraulic Drive** with each ram on the same shaft as the operating piston (no levers, yokes or other complex connections) . . . **Quick-Drain Ram Compartments** that prevent detrimental accumulation of mud and sand—*and many other unique advancements found only in Shaffer Preventers.*

Whether your operations are in remote areas where transportation is a problem, or in domestic fields where the easier installation and handling advantages of lightweight equipment are important, it will pay you to investigate Shaffer Type "LWS" Gates for *your* operations. See your nearby Shaffer representative for complete details—or write direct!

SPECIFICATIONS ON POPULAR SIZES OF SHAFFER TYPE "LWS" BLOWOUT PREVENTERS

Nominal API Size	Working Pressure	Test Pressure	Vertical Bore	Approx. Weights		Approx. Saving in Weight*
				Single	Double	
6"—3,000# W.P. (6" Series 900)	3,000 PSI	6,000 PSI	7 1/16"	780 lbs.	1,420 lbs.	67 %
6"—5,000# W.P. (6" Series 1500)	5,000 PSI	10,000 PSI	7 1/16"	1,410 lbs.	2,610 lbs.	55 %
8"—3,000# W.P. (8" Series 900)	3,000 PSI	6,000 PSI	9"	1,100 lbs.	1,950 lbs.	64 %
10"—3,000# W.P. (10" Series 900)	3,000 PSI	6,000 PSI	11"	2,100 lbs.	3,850 lbs.	45 %

*As compared with comparable equipment now in use.

Write Shaffer Tool Works for information on larger bore sizes.

37 years OF OIL TOOL LEADERSHIP

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HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

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OKLAHOMA CITY, OKLAHOMA, Shaffer Tool Works, Post Office Box 546
FARMINGTON, NEW MEXICO, Shaffer Tool Works, Post Office Box 1788
CASPER, WYOMING, Shaffer Tool Works, Post Office Box 827
HOUMA, LOUISIANA, Shaffer Tool Works, 500 Fifth Avenue, New York, N.Y., U.S.A.
EXPORT SALES OFFICE, Shaffer Tool Works, 500 Fifth Avenue, New York, N.Y., U.S.A.
IN CANADA, Shaffer Western Hemisphere, Inc., 5823 103A Street, Edmonton, Alberta.

the creep-rupture test machine in operation. Source: **Superior Tube Co., 1854 Germantown Ave., Norristown, Pa.**

Liquid-level controls

. . . are illustrated in new 12-page Catalog Section 4A, yours for the asking. It describes displacement-type liquid-level controls for actuating pumps, valves, and high and low level alarms. The publication contains technical and design operating advantages, full model and component descriptions, and installation dimensions. Source: **Magnetrol, Inc., 2110 S. Marshall Blvd., Chicago 23, Ill.**

Chemical-resistance report

. . . of three polyesters after a 6-month immersion in various corrosive aqueous solutions, is now being offered free. The polyester resins tested were bisphenol-A, isophthalic, and general purpose. The report is made up in two sections: (1) a 12-page description of the test techniques and results of a 3-month immersion period and (2) a four-page supplement that includes tables and curves of the behavior of the resins in the 6-month period. Source: **Chemicals Div., Atlas Powder Co., Wilmington 99, Del.**

Pressure-reducing and relief valve

. . . designated the 3851, Type F, is introduced in a new catalog sheet. Available in ½ and ¾-in. sizes, the valve is designed for use in water, oil, air, or gas service to initial pressures of 4,000 psi. The catalog sheet includes valve drawings, capacity charts, valve features, operation, applications, description, and ordering information. Source: **Atlas Valve Co., 280 South St., Newark 5, N. J.**

High-pressure flow indicators

. . . and alarms are discussed in new Bulletin 132, now ready for distribution. It describes flow-rate-measurement meters designed to operate at pressures up to 1,500 psig. The models are available in ½, 1, and 1½-in. sizes to handle flow in ranges from a minimum of 1.5 gallons per hour to 50 g.p.m. The two-page bulletin presents photos, flow ranges, dimensions, and a cutaway drawing which points out design features. Source: **Brooks Instrument Co., Inc., Hatfield, Pa.**

Paint

. . . protects outside metal against rust and weather damage, as discussed in

THE STORY OF THE
AMERICAN PETROLEUM INSTITUTE
(With Personal Reminiscences)
A Study and Report
By Leonard M. Fanning,
Editor World Petroleum Policies
$5.00 plus postage (U. S. 14c)
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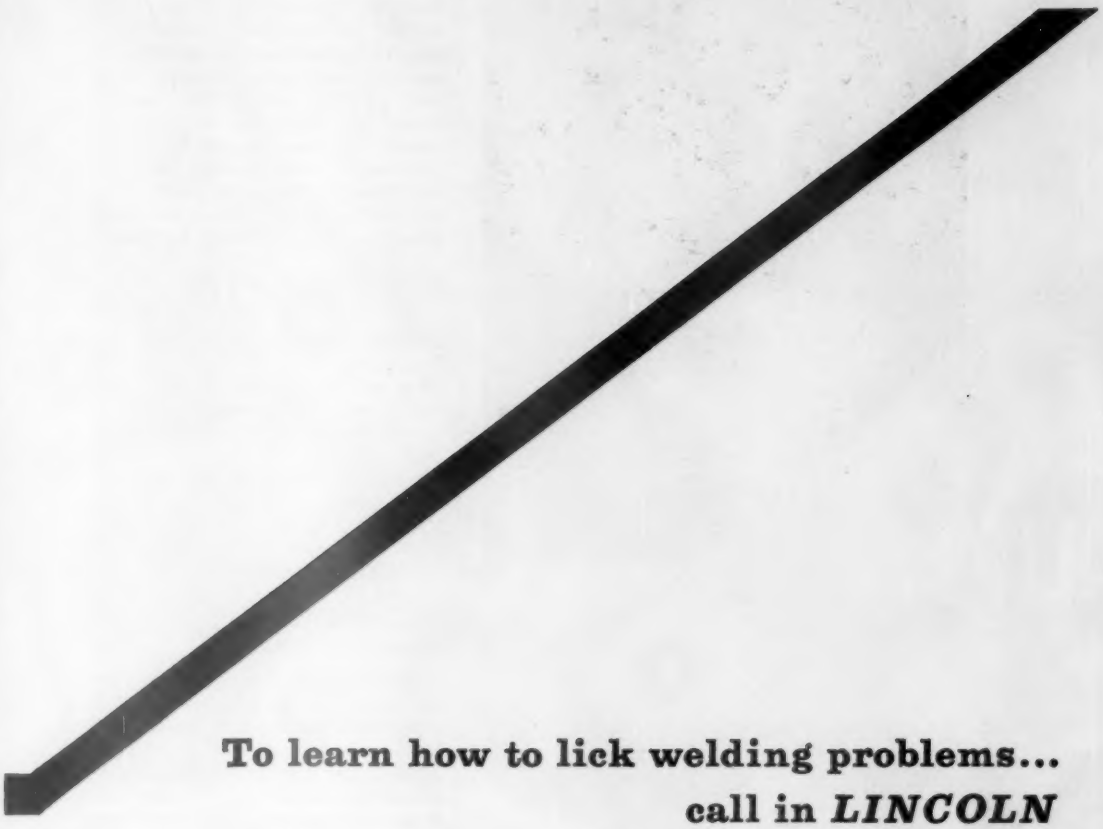
=COMPETENT OILWELL DRILLING AT THE
LOWEST TOTAL COST

To learn how an Aardvark licks termites...
call in a *ZOOLOGIST*

(specialist on animals)

A native of Africa, the AARDVARK is a large, nocturnal, burrowing mammal subsisting largely on termites and has a long extensile tongue for gathering them. He has heavy claws for ripping open rotten logs to find more termites.



To learn how to lick welding problems... call in *LINCOLN*

(specialists in arc welding)

WHETHER you're laying a 30" line from the Four Corners to 'Frisco or a 24 incher from Port Arthur to Pensacola, the thing you need least is maintenance problems. Specially on welding equipment with the stringer bead crew setting the pace for all other crews and hundreds of thousands of dollars of equipment following at that pace, you'd better have welders that will stand the gaff.

That's why along pipe lines the world over, where the going is toughest, you'll find battered, mud-splattered LINCOLN engine-driven welders stringing pipe by the mile. Year after year, LINCOLN sells more engine-driven welders than all the rest of the industry combined—and for just one reason: dependable performance for longer periods with less maintenance.

LINCOLN Field Engineers are specialists in welding techniques and applications. They're backed up by LINCOLN'S wide experience in working with pipeliners on pipe line problems. Take advantage of this experience. To avoid problems, stick to LINCOLN engine-driven welders. If you have problems, call your LINCOLN Field Engineer.

Write for "Welding Pressure Pipe Lines and Piping Systems"

THE LINCOLN ELECTRIC COMPANY
Dept. 2550 • Cleveland 17, Ohio

LINCOLN WELDERS

LATEX QUALITY PIPELINES
BRING REPEAT BUSINESS

For over a quarter of a century the Quality line has been synonymous with the name *LATEX*. *LATEX* is renowned for their ability to build quality line rapidly and efficiently.

REMEMBER, LATEX QUALITY BRINGS REPEAT BUSINESS "AGAIN AND AGAIN"

Another quality service of *LATEX* is CONSTRUCTION OF PEAK SHAVING PLANTS. Pictured here is Atlanta Gas Light Company's Riverdale peak shaving plant near Atlanta.

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Bulletin RAR, now being distributed. Rustrum (rust-remedy) is said to be suitable for machinery, metal buildings, roofs, ventilators, window frames, furnace mountings, containers, tanks, vats, grills, railings, fire escapes, drains, and steelwork. Requiring no primer, the paint is said to form a tight seal to resist moisture, temperature changes, chemicals, mild acids, and fumes. Source: **Speco, Inc., 7308 Associate Ave., Cleveland 9, Ohio.**

Anticorrosive paints

. . . are illustrated in new Technical Bulletins 5 and 6, just announced. The first is devoted to Aluminox and HR (heat resistant) paints, for use where decoration is desired along with chemical and heat-resistant properties. Bulletin 6 describes "double-coat" paints designed to yield a dry-film thickness equal to two conventional coats, but with only a single brush or spray application. Source: **Subox, Inc., Fairmount Plant, Hackensack, N. J.**

Air-dried protective coating

. . . for use as a lining for tanks and for storage or handling of water at temperatures in the 200° F. range, is featured in Bulletin M-7, yours upon request. The publication contains results of 6 years service of Plasite 7155 in hot-water storage tanks, condensate receivers, and similar applications. The coating is said to have excellent resistance to high-temperature brine, caustic solutions, and solvents. Source: **Protective Coating Corp., Green Bay, Wis.**

Corrosion-resistant pipe wrap

. . . for protecting pipelines, process plant lines, and for industrial use, is described in a new 10-page brochure now available. It covers the advantages of using laminated butyl rubber and plastic tape in combination with a butyl-base primer. The brochure contains specifications on Plicoflex tape, shows plant facilities, and includes various uses of the tape. Source: **Plicoflex, Inc., Box 45911, Houston 45, Tex.**

Pipe and block insulation

. . . of calcium silicate is outlined in a new six-page folder which lists data concerning the new industrial insulation product for temperatures up to 1,350° F. Form 6472 lists heat transmission data, physical and thermal characteristics, conventional sizes, and recommended thicknesses in easy-to-read tabular form. Source: **Philip Carey Mfg. Co., 320 S. Wayne Ave., Cincinnati 15, Ohio.**

Versatile Ford Industrial Engine helps portable fracturing rig boost oil well production!

Know why more and more oil field jobs are being powered by Ford Industrial Engines? One reason is Ford's *high power-to-weight ratio.*

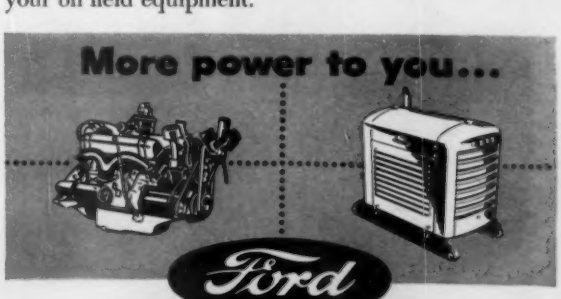
Oil men find that Ford's full line of Short Stroke, low-friction engines provides all the power they need, yet are light enough to permit the moving of portable service equipment from well to well. Other Ford advantages that appeal to profit-minded operators include:

- **Overhead Valves** – for economy, easier servicing.
- **Deep-Block Construction** – for longer engine life.
- **Choice of Engines** – ranging from 134 to 534 cubic inches, including 4-, 6- and 8-cylinder models. All are available as engine assemblies or power units.
- **Choice of Fuels** – gasoline engines can be adapted for LP-Gas or natural gas fuels. Or there are two highly economical Ford Diesels if you prefer.

FORD POWER IS RIGHT FOR YOUR OIL FIELD EQUIPMENT, TOO!

- **Excellent Service** – offered by more than 10,000 Ford Dealerships in the U.S. alone. They can help you keep downtime costs at a minimum with prompt parts delivery, on-the-spot service.

So to get the most for your power dollar, specify Ford Industrial Engines the next time you power or repower your oil field equipment.



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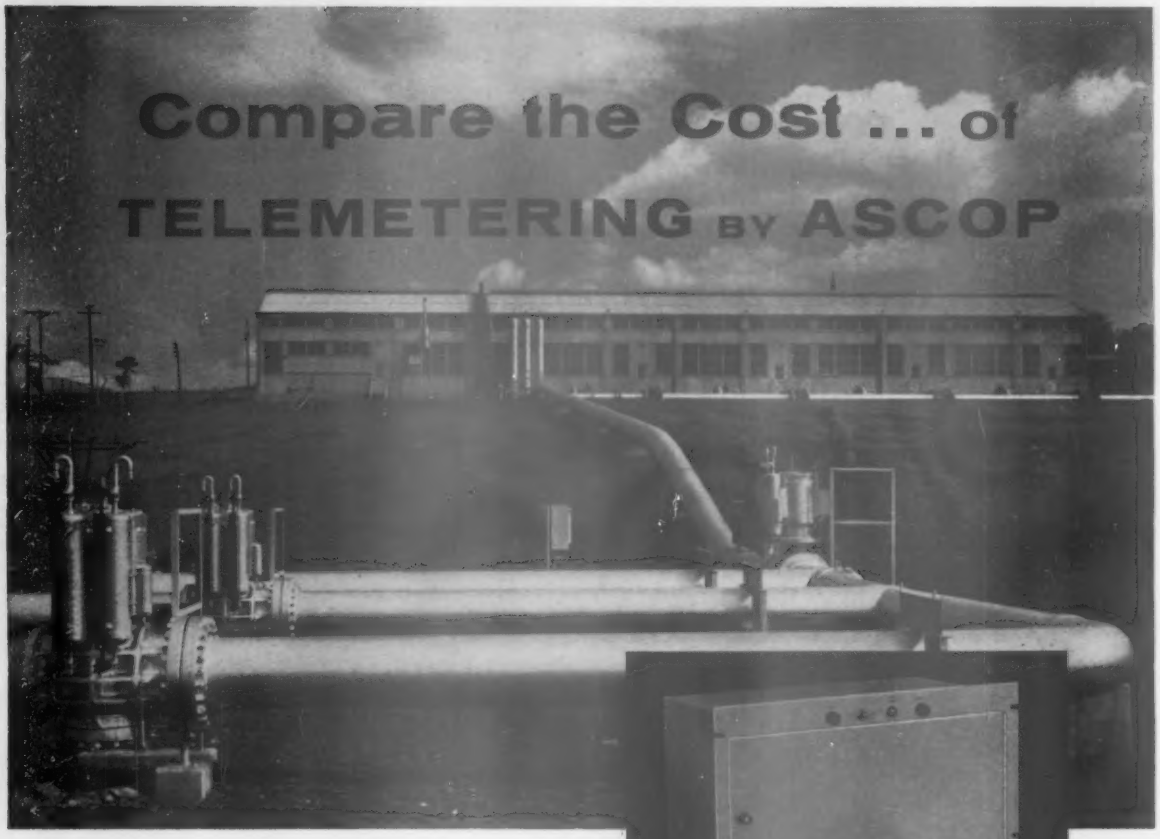
INDUSTRIAL ENGINES
AND POWER UNITS

INDUSTRIAL ENGINE DEPARTMENT, FORD DIVISION, FORD MOTOR CO., P.O. BOX 598, DEARBORN, MICH.

West of Rockies write to:
FORD INDUSTRIAL ENGINE DEPT., P.O. BOX 6787, LOS ANGELES 22, CALIF.
FORD INDUSTRIAL ENGINE DEPT., P.O. BOX 1666, RICHMOND, CALIF.



COMPARE ASCOP with any competitive telemetering system . . . and you'll find that ASCOP telemetering invariably costs least per point when you telemeter over four points.

Installation is less costly too and ASCOP's unique telemetering code permits transmission over lowest-cost leased telemeter-grade lines.

NOTHING TO BURN OUT OR WEAR OUT

All this is packaged in a rugged cabinet and circuits are all solid state. There is nothing to burn out or wear out. System accuracy is better than 1%. For multi-point telemetering systems, ASCOP telemetry adds up to lowest first cost, low installation cost, very low operating and maintenance cost. Let us show you how much you can save with an ASCOP telemetering system.

CONDENSED SPECIFICATIONS

TRANSMITTER: Input Signal: +1 to +5 Volts.
Output Signal: Contact opens and closes in coded form.

RECEIVER: Input: Pulses of 17 Volt d-c min.
Output: One per point, each a 1-5 ma current source.
Accuracy: Over-all System, 1% maximum.

For Detailed Cost Information, Write:

emr ASCOP

P. O. Box 3041, Sarasota, Florida

Electro-Mechanical Research, inc.

▶▶▶ Equipment Men Notes

Climax Specialty Mfg. Co. forms

. . . a new company to distribute, sell, and service its own products. The company will operate under the name Climax Engineering Maintenance Co., with its home office in Houston. Sales and service representatives and warehouses are in Baton Rouge, Lafayette, Tulsa, Los Angeles, Midland, Denver, Chicago, Louisville, Charleston, and Wilmington.

The products of Climax Specialty Mfg. Co. were formerly distributed through a manufacturer's representative, Delta Engineering Sales Co. and Desco Service Co., of Shreveport, under the tradename "Desco." They are now being distributed by Climax Engineering under the tradename "Climax." Climax 600, 400, 750, and 650 were formerly called "Desco" with the same numbers.

Climax Engineering Maintenance has established a valve lubrication and reclamation service using fully equipped trucks with trained personnel to service lubricated valves in refineries, chemical plants, gasoline plants, pipelines, and production fields and to repair valves on the spot at a plant.

Principals of the new company are: W. E. Hamm, president; Albert Rickords, vice president; B. J. Winborn, secretary-treasurer; and Paul E. McKenna, general manager.

J. W. Northcutt takes over

J. W. Northcutt

. . . as assistant vice president and manager of the Petroleum & Industrial Meter Division, Rockwell Mfg. Co., announces L. A. Dixon, Jr., vice president. Northcutt was formerly an assistant vice president in Rockwell's Municipal & Utility Division.

He joined Rockwell in 1937 as a sales engineer, was promoted to Atlanta district manager in 1949, and southern regional manager in 1952. He assumed his most recent position in 1956.

Trinity Steel Co., Inc. names

. . . Rex Bircket as custom sales representative in the Tulsa area, according to Elmer E. Garnsey, vice president in charge of sales. Bircket formerly served with Cities Service Oil and Stanolind Oil & Gas in engineering capacities. He then worked as a sales engineer for an equipment supply house before forming his own business as an independent manufacturers representative.

Hughes Tool Co. announces

. . . the appointment of James R. Lesch to the newly created post of general product manager, reports M. E. Montrose, senior vice president and general manager. Lesch will head a staff responsible for reviewing and coordinating marketing programs, evaluating and controlling product change requests, and finished inventory planning for all Hughes products.

J. R. Lesch J. Z. Brewer

His staff consists of J. Z. Brewer, manager of product coordination; A. G. Davis, manager of distribution inventory planning; and W. A. Kistler, Jr., product manager of rock bits.

A. G. Davis W. A. Kistler, Jr.

Lesch joined the company in Oklahoma City in 1946 as an engineer trainee. His assignments have included district, division, and regional engineer; district sales manager; division sales manager; and product manager of rock bits. Brewer started with Hughes 8 years ago. He became assistant chief industrial engineer in 1956.

Davis went to Hughes in 1927 as secretary to the general manager, after which he went into general sales. From 1940 until the present, he served as office manager for the sales department. Kistler joined the firm as a laboratory technician in 1947. Since then he has worked as laboratory drill-rig supervisor, product development engineer, and regional field engineer.

Paul H. Smith is appointed

. . . vice president for construction of Vitro Engineering Co., working out of New York. Prior to this appointment, Smith was manager of the Tulsa office of Vitro's Treco Division. He joined Refinery Engineering Co. in 1947, and was vice president before its merger with Vitro Engineering a year ago. Before that, he was an operating engineer for Kanotex Refining Co. for 10 years.

Halliburton Co. is awarded

. . . a bronze "Oscar" at a banquet in New York City as one of the winners in the 20th Annual Report survey sponsored by Financial World, national weekly magazine.

Close to 5,000 reports were reviewed in 96 categories during this year's competition. In the industrial-equipment classification, Halliburton won top honors in a field of 20 merit-award winners from which the Oscar winner is selected.

This marked the firm's second first-place trophy, the other being won in 1956. Halliburton has ranked among the top three recipients of the annual report awards every year since it became a publicly owned corporation 12 years ago.

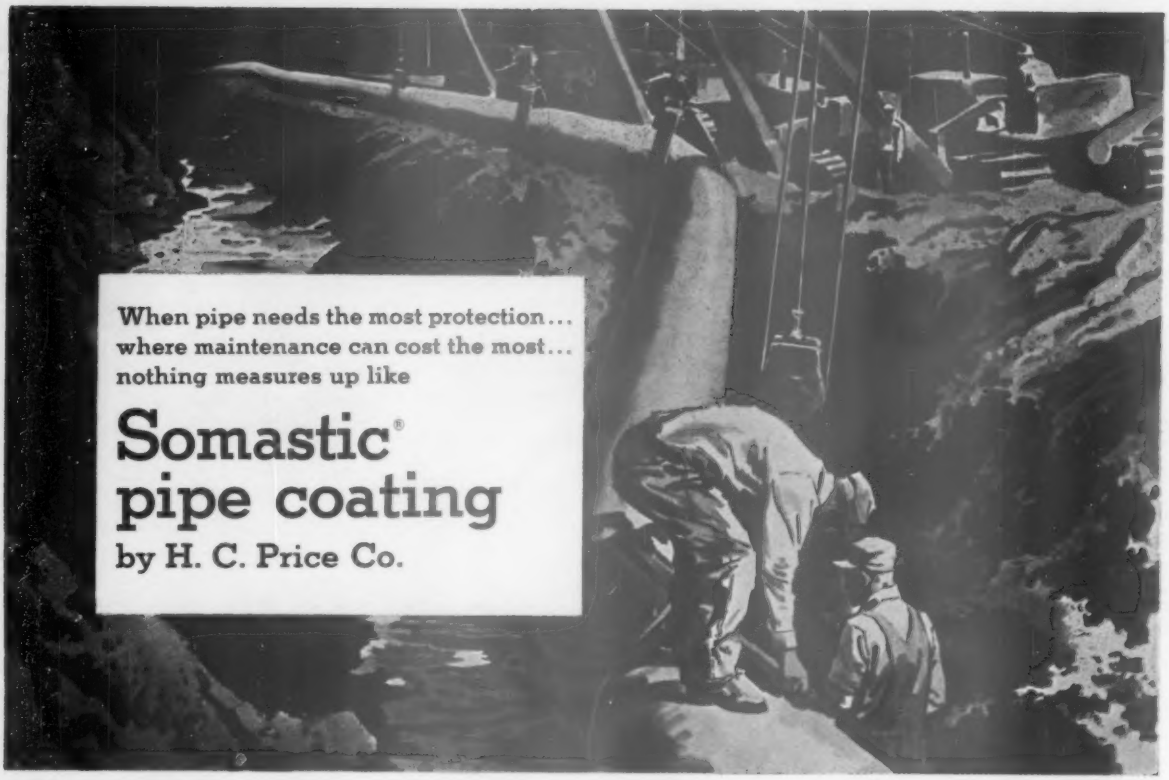
R. J. Bunch is named manager

. . . of Ingersoll-Rand Co.'s Centrifugal Pump Division, announces J. A. Wiendl, general manager of sales. Also appointed to new positions were: G. T. Jones, manager of the condenser department; and T. E. Bennett, manager of the engineering pump department.

Prior to this assignment, Bunch was manager of the company's condenser department. He was appointed sales engineer in the company's Boston office in 1940 after serving in that capacity in the New York and Los Angeles offices. He became manager of the condenser department in New York in 1956.

Jones joined Ingersoll-Rand in 1939. He was first assigned as an engineer in the company's condenser engineering department in Phillipsburg, N. J., and in 1944 was transferred to the condenser sales department. Jones was named chief engineer of the department 3 years ago.

Bennett joined the company in 1949. As an application engineer in the Centrifugal Pump Division he was closely



When pipe needs the most protection... where maintenance can cost the most... nothing measures up like

Somastic® pipe coating

by H. C. Price Co.

Today, in the swamplands . . . in highly corrosive soils . . . in seawater itself . . . SOMASTIC® gets the call from the nation's pipeline men. They *know*, from scientific examinations made of SOMASTIC®-coated lines that have been operational as much as 30 years, that this asphalt-mastic coating keeps on protecting against corrosion long after other coatings have developed costly holidays.

EXAMPLES: 10″ and 8″ product line running 115 miles through the waters and muck of the Louisiana swamps, in operation over 18 years; a 25-mile, 14″ line laid deep in the bottoms of Lake Pontchartrain, now in its 19th year; 335 miles of 6⅝″ pipe from Kansas to South Dakota, now in its 20th year. (Details on request.) These are but three examples of the scores of pipelines, totaling thousands of miles, that have been protected against corrosion by SOMASTIC® pipe coating.

How about the economics? Today, the H. C. Price Co. Pipe Coating Division offers SOMASTIC® pipe coating at prices sharply competitive with enamel wraps or other coatings. Low initial cost combines with predictable low maintenance costs for the most favorable pipe coating economics available. Because of its greater weight, SOMASTIC® offers considerable savings where weight is a factor, such as in marine or swamp installations.

Want the proof? Substantial material is available on periodic examinations of SOMASTIC®-coated pipe. Mail the coupon below for reprints for your file, plus the newly issued book on SOMASTIC® use and specifications. No obligation, of course. Information is also available on HEVICOTE® concrete coating, including weight and displacement tables.

COATING
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CONTRACTORS

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Price Tower, Suite 155 Bartlesville, Oklahoma

☐ Send me current information, including scientific papers, about the corrosive protection and weight advantages offered by SOMASTIC® pipe coatings.

☐ Send me information about HEVICOTE® concrete coating, including weight and displacement tables.

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Address_____

City and State_____

pipe coating division

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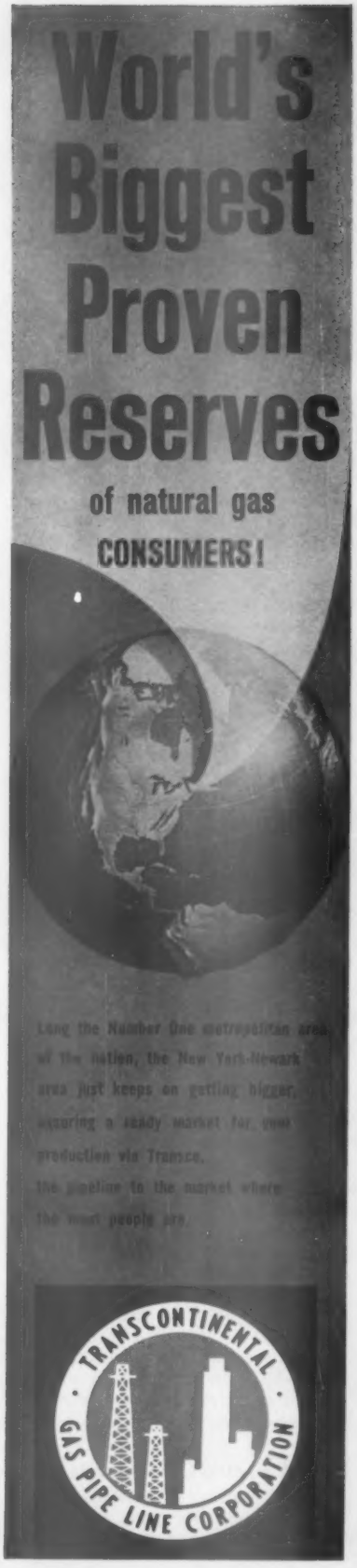
Gulf Coast Plant: P. O. Box 263 • Harvey, Louisiana

East Coast Plant: P. O. Box 6120, Bustleton • Philadelphia 15, Pennsylvania

Cable Address: HCPCO



associated with the development of pumps for the marine industry, particularly in the nuclear field. More recently he was manager of overseas sales for that division.

Samual C. Welker becomes

... resident manager and sales manager of BS&B's newly formed Swiss subsidiary, Black, Sivalls & Bryson, S.A., according to Lawton L. Laurence, general manager of Eastern Hemisphere operations.

Laurence also announced the appointment of Raymond R. Wilson as

S. C. Welker

R. R. Wilson

supervisor of order processing for Black Sivalls & Bryson (Nederland) N.V., The Hague. Wilson has 25 years of manufacturing, sales, and administrative experience in the oil-field-production-equipment field.

Welker, who will be responsible for sales of oil-field and control equipment in Central and southern Europe, North Africa, and the Near and Middle East, will headquarter at Zug, Switzerland. He has a long record of international sales and management experience, most recently serving as vice president and division manager of Security International, C.A., a subsidiary of Dresser Industries, Inc.

T. L. Parrish assumes post

... as service representative in the Houston area for Hunt Tool Co. In addition to specializing in section and liner milling operations, he will solicit both sales and rental of Hunt-manufactured products such as stabilizers, reamers, and drill collars.

Before joining Hunt's service division, Parrish was general manager of Superior Oil Tool Co. For 12 years he was with A-1 Bit & Tool Co., serving as district manager in Odessa and Corpus Christi, Tex.

V. L. Ackerman joins Motorola

... as an industrial communications representative in Louisiana, Mississippi, and the Texas Gulf Coast, in which post he is responsible for the sale of microwave equipment. Ackerman, who has been in the pipeline industry for the past 5 years, will headquarter in Houston.

SENIOR

flangnek standard meter tubes

Used at sales and purchase stations everywhere, Daniel Senior "flangnek standard" meter tubes meet exacting service requirements. They are easy to order, cost less, and are available from stock. Special, factory-aligned upstream tubes combine with the Senior Orifice Fitting to provide a smooth approach to the orifice plate, free of offsets. The popular Senior fitting allows fast plate changing or inspection without line-shut-down. See your Daniel representative for the full story on your best buy in meter tubes.

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Dependable performance in all oil and gas applications

Koppers Piston Rings are now available in the field in a complete range of materials and a wide selection of types and sizes for every application in the oil and gas industry

For trouble-free performance, lower operating costs, less down-time, select Koppers Piston Rings—choice of many original equipment manufacturers.

Koppers Piston Ring dependability, in even the most rugged applications, is backed with 38 years of experience in manufacturing rings of predictable performance.

If you have a ring problem, consult your Koppers field agent or write: KOPPERS COMPANY, INC., Piston and Sealing Ring Department, 6611 Scott Street, Baltimore 3, Maryland.

Send now for Koppers recommended Piston Ring Set-Ups applicable to the engines which you operate.

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Cable Add. "TOYOKANETSU TOKYO"

James R. Craine is promoted

J. R. Craine

. . . to assistant manager of the east-central sales district of Cooper-Bessemer Corp., reports F. M. Devin, vice president and east-central district manager of the Mount Vernon, Ohio firm.

Craine went to C-B in 1952 as a sales engineer. He was promoted to branch manager of the Mount Vernon sales office in 1958.

General Kinetics Corp. licenses

. . . Elliott-Automation, Ltd., of London, England, to manufacture and sell the P-K Paul valve outside the Western Hemisphere. The English firm has 12 plants located throughout the British Isles, in Australia, and on the Continent.

At the same time, General Kinetics was appointed sole distributor for the complete line of Black automatic controls manufactured by Elliott-Automation, including pressure switches, constant-flow valves, solenoids, and a new type of rotary valve which is capable of pneumatic programing. This equipment will be handled throughout the United States and Canada.

BJ Service, Inc. opens

. . . a new cementing service station in Kingfisher, Okla. This move follows, by less than a year, the company's entry into Oklahoma cementing service in 1959 when an operation was inaugurated in Woodward. Moving from Chickasha, Okla., is Chester Chandler, who will be field supervisor in charge at Kingfisher.

E. E. Stanley takes over job

. . . as district representative at Denver for Oil Well Supply Division of U. S. Steel Corp., reports A. S. Finefrock, the division's Rocky Mountain area manager. Stanley was employed by Oilwell in 1953 at Duncan, Okla., and was appointed field representative there a year later.

He retained the position of field representative upon his transfer to Healdton, Okla., in 1955. The following year he was sent to the division's Dallas headquarters office and appointed assistant to the manager of production-equipment sales.

Lincoln Electric Co. appoints

. . . A. F. Boucher as assistant general sales manager. He came to Lincoln in 1936 and was made a district man-

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ager in 1939, after 3 years as a field engineer in the Cleveland and Detroit offices. Boucher was district manager in the company's Milwaukee and Detroit territories for 18 years. He was Lincoln's Detroit district manager at the time of this appointment.

J&L Supply Division appoints

. . . new store managers at Freer, Tex., and Lake Charles, La., according to A. G. Bastian, manager of field operations. R. J. Bevington, former salesman at McAllen, Tex., takes over at Freer, and R. S. Allison, a salesman at Beaumont, assumes duties at Lake Charles.

W. L. Wolfe, J&L's vice president in charge of sales, announced three changes in the division's field sales organization. T. M. Bailey, store manager at Electra, Tex., has been assigned as salesman there; J. R. Carson, salesman at Duncan, Okla., will continue in the same capacity at Healdton, Okla.; and D. P. Loyd will take over duties as salesman at Wichita Falls, Tex. He moves from a similar post at Snyder, Tex.

James E. Van Effen becomes

. . . sales manager of Region No. 2 for Nelson Electric Mfg. Co. He was formerly manager of commercial service for General Electric's circuit protective device department at Plainville, Conn. With offices in Chicago, Van Effen's territory covers parts of Missouri, Michigan, Iowa, Illinois, Wisconsin, and Minnesota.

15-YEAR SERVICE PIN is presented to Robert Harcus (left), vice president and general manager of Byron Jackson Tools, Inc. by Andrew W. Rose, president of Byron Jackson Division of Borg-Warner Corp. In making the award, Rose commended Harcus for "spearheading on extensive oil-products research and development program that has resulted in important new tools for the oil industry, as well as major advancements in the design and capabilities of existing tools."

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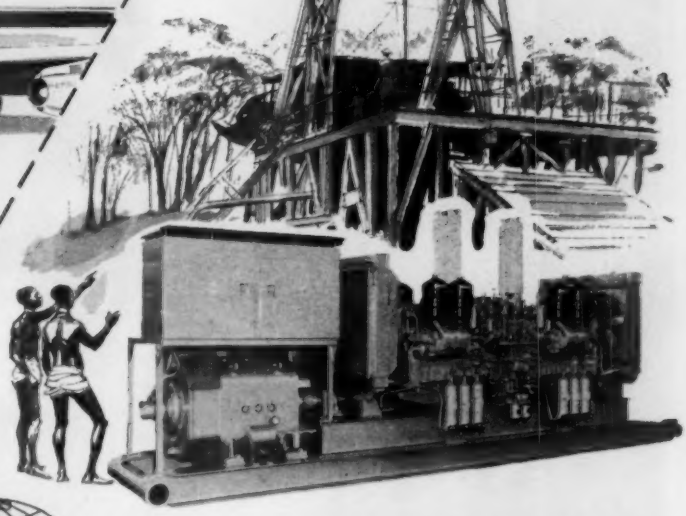

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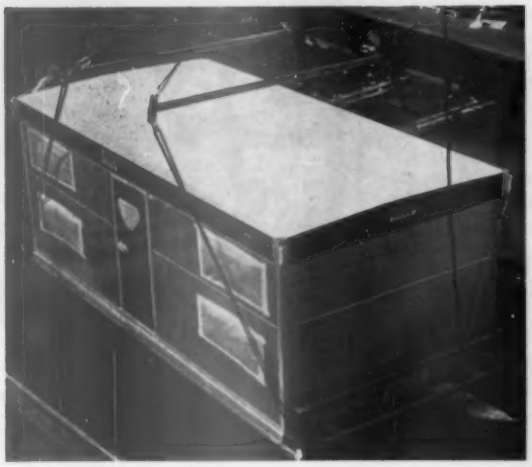


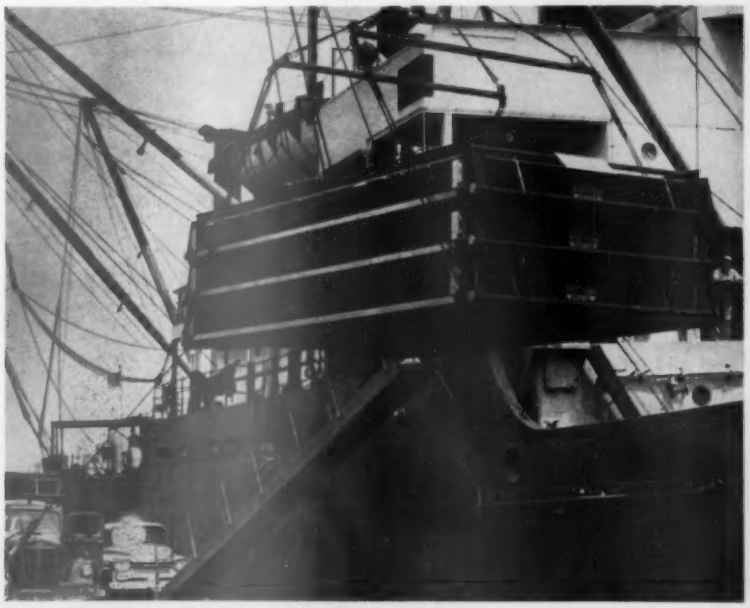
ERECTED buildings are used to ship camp materials inside them. Here is an S-series house used as a shipping case to store utensils and furniture.

Portable houses slated for use in Libya

A SMALL VILLAGE—36 insulated buildings—is going to be built in Libya with portable houses. The housing was shipped from the Port of Houston recently as one of the year's largest orders of Porta-Kamp Manufacturing Co., Inc., of Houston.

The firm specializes in the manufacture of portable units, sent the buildings to the desert where they will be erected and used by a major oil company. Since oil was discovered in Libya in 1958, drilling crews, exploration base camps, and operating camps have used various types of housing.

The 36 units, loaded on 14 trucks, were crane-hoisted aboard the S.S. Santa Regina, a States Marine vessel. All but three were shipped knocked down, a procedure which the firm claims can save the purchaser up to



KNOCKED DOWN FOR SHIPMENT TO LIBYA, these three S-series Porta-Kamp buildings are loaded aboard S.S. Santa Regina at Houston.

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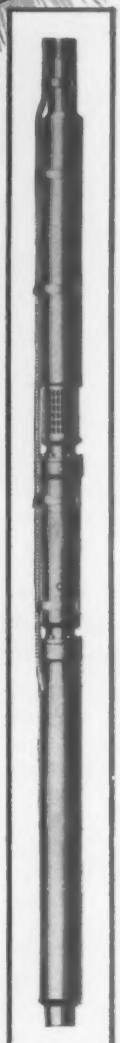

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75% in transportation costs. Those three erected units were packed with materials which included containers for the bunks, mattresses, and lockers to be used in the entire village.

Each of the buildings is 10 by 20 ft. and are made of wooden frames with aluminum siding insulated with glass fiber linings. The insulation will protect the inhabitants in 110°-120° desert heat. All are mounted on steel skids and have paneled interiors, abundant electrical outlets, and can be readily heated or air-conditioned.

Units similar to these slated for Libya have been shipped by Porta-Kamp to Africa, Turkey, Iran, India, South America, Alaska, and the Philippines. Experience has proved that this type of building is readily adaptable to varying weather conditions throughout the world. They are easily set up by untrained personnel without difficulty.

The firm makes a wide range of styles and sizes of portable camp buildings including lightweight, medium-weight and heavy-duty types. They may be used singly as housing units, laundries, kitchens, baths, and offices, or in combination as dormitory or dining facilities. Collapsible buildings are not Porta-Kamp's only line, it also makes permanent units for all types of camps.

Complete outfitting for camp equipment is another phase of the firm's line. They will provide everything including the design of the camp layout to providing all necessary equipment, including silverware, kitchen utensils — pots, pans, cutlery — and linens.

Porta-Kamp was incorporated in 1956, has enjoyed rapid growth, and now has an organization of foreign representatives. Home offices of the company are 716 West 16th Street, Houston.

Mountain activity down

ACTIVE ROTARY RIGS and total number of well completions for the last week in October is still running below 1959 figures. In the Rocky Mountain states for the week ending October 28, total number of active rigs and total completions were about 10% lower than last year.

In all operations, 102 wells were completed during the week with 28 of these listed as wildcats. Four of the exploratory tests were oil wells while the rest were dry.

Number of current active rigs was 263 compared with 292 for the same period last year.

The most active states were Wyoming and western Nebraska with 12 wildcats each.

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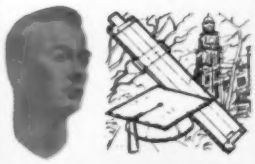
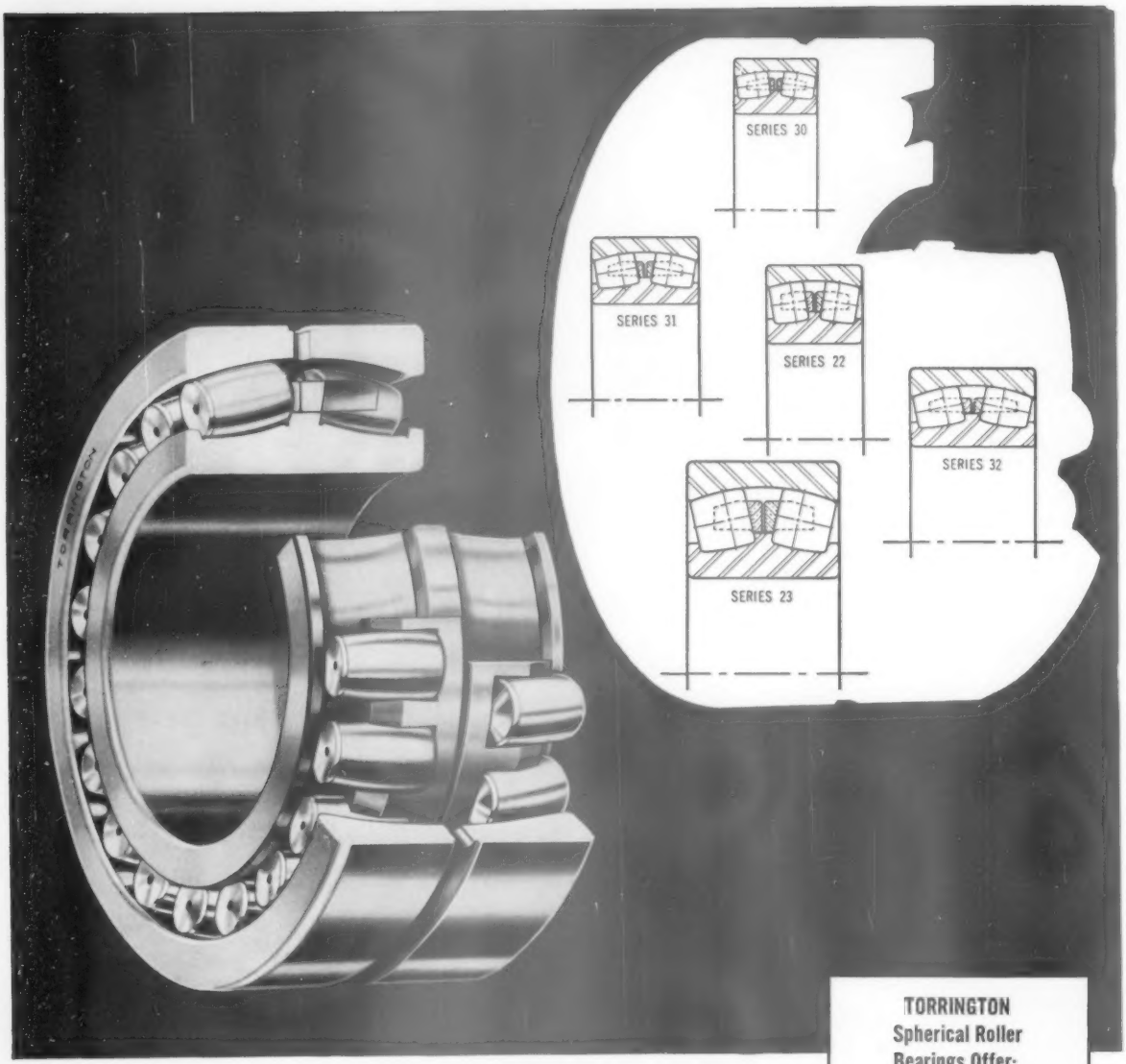


from the ground down



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Nebraska play strides northwest

Events in the Kaneb country point to a new perspective throughout southwestern Nebraska.

AN IMPORTANT indicator of future Rocky Mountain activity is now approaching completion.

This is Sunray Mid-Continent Oil Co.'s 1 Stroup, a wildcat in Section 8-2n-37w, Dundy County, Nebraska. Now in the swabbing stage, final outcome of the well is still pending, but oil recoveries in a series of drill-stem tests point to a new discovery, and possibly the first good oil field in the county.

This is the second in a series of Sunray wildcats in the Kaneb country. The first was a dry hole to the east in Hitchcock County. The third, 1 Anderson, is now drilling 14 miles southwest of the indicated discovery; it is also in Dundy County (Section 28-1n-39w).

Sunray moved into this region soon after the discovery of Llanos and Cahoj fields in northwestern Kansas (see map). Now, after extensive seismic surveys and subsurface study, the company is testing some small structural anomalies that came to light in those surveys.

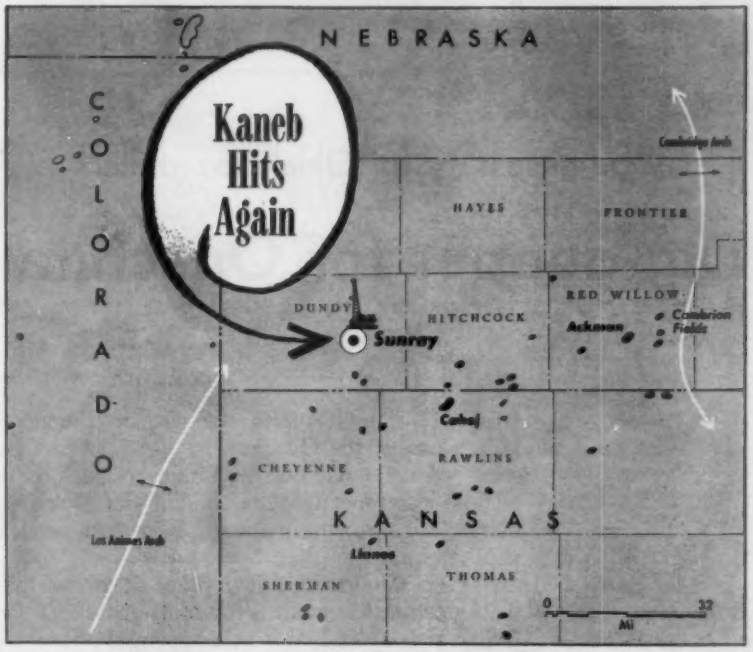
The 1 Stroup was bottomed at 4,510 ft. Electrical log of the well revealed possible pay zones in the "H" and "A" sections of the Lansing-Kansas City (Pennsylvanian) formation. Two drill-stem tests were run in the "A" section, and three in the "H". Best recovery was from 90-minute test of the "A" at 4,135-60 ft.; results were 724 ft. of free oil, 30 ft. of heavily oil-cut mud, and 806 ft. of gas. There was no water. Second-best recovery was from first 90-minute test of the "H" at 4,270-4,305 ft.; here, 650 ft. of mud-cut oil (75% oil) was recovered.

The apparent new strike lies 2 miles northeast of an old dry hole drilled by Deep Rock Oil Co. years ago; this well (in Section 20-2n-37w) went to 5,153 ft. and topped Precambrian at about 5,100 ft. Four miles southeast of the new well, Ohio Oil Co. drilled a 5,096-ft. failure in Section 33-2n-37w; this one had a show of oil in the Lansing section.

Other than a half-dozen wells clustered southeast of Benkelman Townsite, 7 miles south of the Stroup discovery, only 6 other wildcats have made the scene in Dundy County. And herein lies the importance of Sunray's feat. Success at 1 Stroup will open lots of new territory in the extreme eastern lobe of the Cretaceous Denver basin to Pennsylvanian oil-hunting. The play could involve all of Dundy, Chase, Hayes, Keith, and Perkins counties, and parts of Lincoln and Arthur counties. The pre-Mesozoic formations of the entire northern and eastern flanks of the Denver basin should certainly attract much more attention than they've had so far.

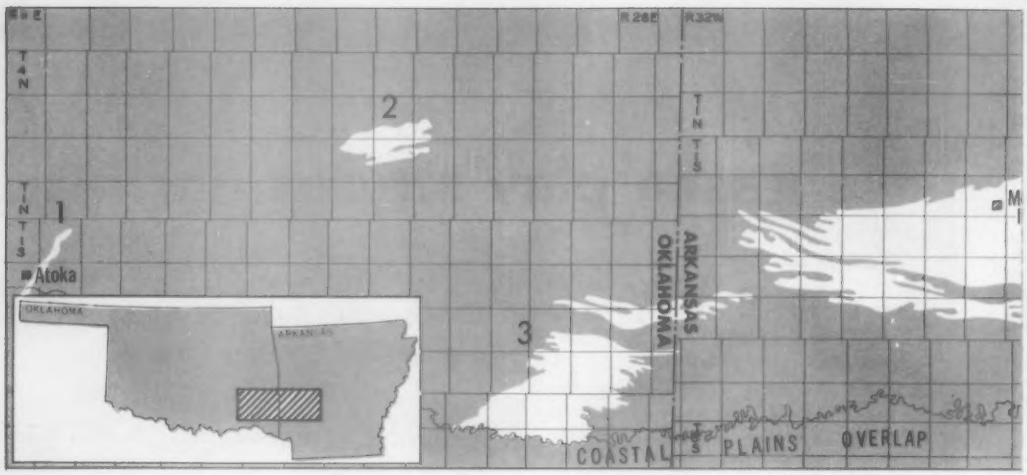
Dundy County sits astride the northeastern limb of the Las Animas arch as it dies out in southwestern Nebraska. The new Sunray well abuts the eastern flank of that arch. Success at future drilling projects will depend on both structure and stratigraphy, but the latter factor will probably play the major role in oil accumulation.

Between the Las Animas arch and the Cambridge arch to the east lies the Kaneb arm of the Hugoton embayment, northern lobe of the Anadarko basin. Oil finders since 1958 have met with luck along the limbs of both arches, and out in the embayment itself. Gradually, as new counties come into the play, the perspective will improve, and southwestern Nebraska will have a full-blown oil boom on its hands.



INDICATED SUCCESS at Sunray Mid-Continent 1 Stroup, Dundy County, Nebraska, promises to open new territory to Rocky Mountain explorers. This is the northwesternmost discovery in the 2-year-old "Kaneb embayment" play; it lies 23 miles northwest of nearest good Pennsylvanian field at Cahoj, Rawlins County, Kansas.

BY FRANK J. GARDNER



It may be necessary for Oklahoma drillers to . . .

Dig deeper for Ouachita reserves

BY WILLIAM D. PITT
University of Oklahoma, Norman

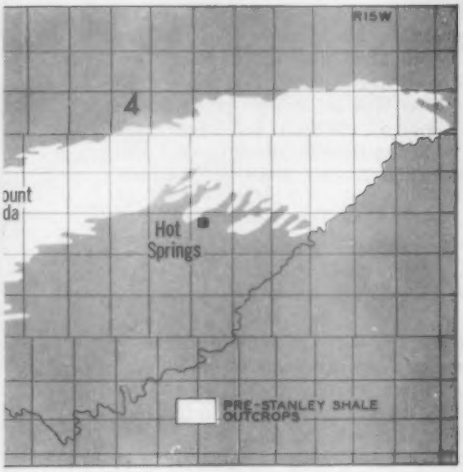
RECENT DISCOVERY of gas in commercial quantity in the Potato Hills area of the Ouachita Mountains dramatizes the fact that Ordovician rocks of the Ouachita Mountains (Ouachita facies) represent a legitimate oil and gas objective; and that if the rocks here in the Potato Hills were metamorphosed, the metamorphism had no deleterious effect upon the gas pool.

One should be quite optimistic about the oil and gas possibilities of the Ouachita Mountains, for most geologists who have done extensive work in this area agree that it holds promise of being one of the major oil and gas provinces of the United States. The late Sidney Powers, for example, listed the Ouachita Mountains in a general recommendation of seven areas that deserved extensive exploration in the search for major reserves; six are now major oil provinces (Dollie Radler Hall, 1960, personal communication).

Objective: Crystal Mountain and older rocks

All Paleozoic formations of the Ouachita Mountains might locally be permeable enough, either in the form of a local sand zone or in the form of fracture porosity. For example, the gas well in the Potato Hills area (Sinclair 1 Reneau, C SE¼ NW¼ 32-3n-20e) is producing from fractures in the Bigfork chert; elsewhere from this same formation, connate salt water was obtained, a fact which certainly demonstrates their effective porosity. The most promising-looking potential reservoir rocks on outcrop, however, are the Crystal Mountain sandstone and older rocks. Pertinent characteristics of the sandstone beds of these older units are given below.

Quartzose sandstone. The sandstone both in Oklahoma and in Arkansas consists of a pure, quartzose sandstone that is loosely to tightly cemented with dolomite or calcite. In its type area, the Crystal Mountains of southwestern Arkansas, the formation consists of two massive sandstone beds, 40 to 80 ft. thick, which are separated by 100 ft. of thin beds of dark siltstone and shale. Sandstone beds of moderate thickness (up to 20 ft. thick) are found in the more than 100 ft. of section that is above the uppermost



INDEX MAP of pre-Stanley shale outcrops in Ouachita Mountains, Oklahoma. No. 1: Black Knob Ridge, 1,000-ft. test had show of oil in Womble at total depth, faulted anticline. No. 2: Potato Hills, well now produces gas from Bigfork chert, faulted anticline or anticline window. No. 3: Choctaw anticlinorium, show of oil Ouachita facies in well about 6 miles south of Core area, essentially unfaulted anticline. No. 4: No shows reported, central part, anticlinal ridges and synclinal valleys, border area, homoclinal.

massive sandstone member. The formation aggregates (beginning at the base of the lowermost massive bed) almost 400 ft. in its type area. The sandstones throughout this unit are pure, calcareous, or dolomitic sandstones, comparable to the Simpson sands of the Arbuckle Mountains.

Permeability. The late C. W. Tomlinson (and others) have tested the permeability of the outcropping Crystal Mountain sandstone and found it to be very permeable indeed. Admittedly, however, most surface samples are well weathered, a fact which might explain the high degree of permeability of surface samples. Even "shallow" coring of the Crystal Mountain sandstone in its outcrop area should tell us something about the reservoir potential of this and older units; but, unfortunately, even this has not been done.

Older rocks virtually untested. Not only the Crystal Mountain sandstone but also all older rocks of the Ouachita Mountains represent potential oil and gas reservoir rocks insofar as surface-outcrop examination is concerned; and none of these older units have been tested adequately for oil and gas.

In fact, the Crystal Mountain sandstone and older rocks perhaps have not been tested at all (see Branan & Jordan, 1960, p. 145). In Oklahoma the oldest exposed rock unit of the Ouachita Mountains is the Lukfata sandstone. This unit consists of over 100 ft. of massive shelf-type sandstone, with dark thin beds of sandstone, shale, siltstone, and limestone.

In Arkansas, the Collier shale, directly underlying the Crystal Mountain sandstone, is the oldest exposed formation. This unit, like the Lukfata, is dominantly clastic, consisting mostly of thin beds of siltstone and shale.

The oldest exposed bed of the Collier in Arkansas consists of a 10-ft. bed of massive, quartzose sandstone of the Crystal Mountain sandstone type. An unknown thickness of clastics therefore underlies the oldest surface exposures of the Ouachita Mountains, both in Oklahoma (southwest part of Area 3), and in Arkansas (west central part of Area 4).

The Crystal Mountain sandstone and older rocks exposed in the Ouachita Mountains have been correlated either with the Simpson sands or with the underlying Arbuckle limestone. The upper part of the Arbuckle limestone becomes more sandy moving from the western part of the Arbuckle Mountains to the eastern part.

If this more-clastic-eastward trend continues eastward from the Arbuckle Mountains themselves into the Ouachita Mountain area, the Arbuckle equivalent in the Ouachita Mountains must be more clastic and presumably more porous tha nthat unit farther west.

If true, the Ouachita Mountain area during the Arbuckle depositional interval was an area receiving sediments more clastic in nature than those being deposited in the Arbuckle Mountain area. Certainly this more-clastic-appearing sequence is a more attractive objective than the Arbuckle limestone unit of the Arbuckle Mountain area.

Thickness. The thickness of sedimentary rocks beneath the oldest exposed rocks of the Ouachita Mountains both in Oklahoma and in Arkansas is unknown. Estimates of thickness are extremely variable and range up to more than 20,000 ft. (Tomlinson, C. W., 1954, personal communication; see Lyons, P. L., 1950, and other sources). What is actually beneath the oldest exposed rocks in these "core" areas remains a compelling question.

About the author...

DR. WILLIAM D. PITT was graduated from Northwestern University and received an MS degree in geology in 1950. Following 2½ years with Atlantic Refining Co., Houston, he went to the University of Wisconsin and received a PhD degree in 1955. After a year at Lamar College of Technology, Beaumont, Tex., as assistant professor, he joined the staff of University of Oklahoma. Much of his research work in geology has been in the Ouachita Mountains under the sponsorship of the late Dr. C. W. Tomlinson of Ardmore, Okla., and the Oklahoma Geological Survey.

Pre-Stanley shale areas. Other old-rock areas of the Ouachita Mountains besides the Potato Hills area likely will yield oil or gas. Generally they represent promising areas in several respects. Erosion has stripped off the most discouraging formation through which to drill, the Arkansas novaculite. Faulting is locally present in these areas, but this should not be a discouraging factor. Faulting here as elsewhere might cause appreciable fracture porosity, as perhaps it does in the Potato Hills. To point out that each pre-Stanley shale area shows promise, their oil and gas potential is discussed briefly below.

Black Knob Ridge—Area 1

Structure. Black Knob Ridge is a faulted anticline 8 miles long that trends northeastward from a point 1 mile east of Atoka, Okla. The Ti Valley fault borders the anticline all along its northeast flank; locally the northeast flank is completely faulted out. Two subsidiary northeast-plunging anticlines are found along the ridge, presumably as a result of strike-slip movement along the Ti Valley fault. The southernmost one was drilled to a total depth of 1,000 ft. It reportedly contained oil at about total depth.

Oil potential. Hendricks, Misch, Oles, and others have noticed the striking similarity of the surface rocks here with their approximate equivalents in the Arbuckle Mountains. Be-

OUTCROP of the Crystal Mountain sandstone shows its massiveness and resistance to weathering. The sandstone is well sorted, normally loosely cemented quartzose, with dolomite or calcite. Location is NW 9-3s-24w, looking east on Fisher Mountain.

cause no graptolites in the core area of Oklahoma are specific to the Polk Creek shale, the Womble shale and the Bigfork chert, and because only 166 ft. of uppermost Womble is exposed on Black Knob Ridge, it seems possible that the shale as well as the overlying Bigfork may be equivalent to the Viola limestone of the Arbuckle Mountains. It seems probable that the entire Simpson equivalent, as well as the sandy upper Arbuckle limestone, was not penetrated by this 1,000-ft. test.

Oil accumulation certainly is associated with the structure because of the asphalt found at the surface thereon, both in the Bigfork chert and Womble shale formations. Recoverable oil might be trapped either on the crest of the subsidiary anticlines, or generally along the east flank of the anticline, above the Ti Valley fault, below it, or both (see Hendricks, T. A., et al., 1947).

Potato Hills—Area 2

Structure. This area is interpreted either as a window within the Windingstair thrust sheet, or as a complexly faulted anticline. Either way, the central part of the area is anticlinal, and it was upon this central part that the Sinclair 1 Reneau was drilled. The Bigfork chert is said to have been penetrated by the drill three times, a possibility explainable either by faulting or by the drill having penetrated an overturned anticline.

Oil and gas potential. The 1 Reneau was drilled to a total depth of 7,097 ft., in the Collier(?). The well initially produced 1,850 M.c.f.d., open flow with no water. The Crystal Mountain sandstone was reported to have been penetrated at the drilling depth of 6,286 to 7,011 ft.; several geologists, however, believe that the Crystal Mountain sandstone was reached in this well. Two more wells at least will be drilled, perhaps one of which will test (or retest) the Crystal Mountain sandstone (see also Branan & Jordan, 1960, p. 144-146).

Core Area—Area 3

Structure. Perhaps the most attractive thing about the Core area as an oil or gas prospective area is its size. The anticline covers many square miles, and if the crest of it yields oil or gas, there is no way of telling how far down the flank this oil or gas might be found. The crest of the anticline is a low-dip area, one that is essentially unfaulted. Structurally the area is quite promising.

Oil potential. The oldest rock exposed in the Core area is the Lukfata sandstone; the drilling objective is of course the rocks sub-cropping beneath the Lukfata. The age of the Lukfata is not known because in this area no fossils were found in beds below the upper Womble. The Lukfata sandstone might be equivalent to the Simpson sandstones of the Arbuckle Mountains or to the upper part of the Arbuckle limestone. The intriguing question to be answered here, besides finding out if there be oil or gas, is how thick and what sort of sedimentary rocks are beneath the Lukfata. The thickness of the sediments beneath the Lukfata might be more than 20,000 ft. As to the kind of sediment beneath the Lukfata, this part of the Ouachita Mountains indeed might have been a clastic shelf area during the Arbuckle limestone depositional interval, or whatever other interval we might choose for the Lukfata sandstone and older rocks.

Oil shows. Oil shows in the Paleozoic beds are had in two wells that are less than 10 miles south of the Core area. One in particular is the Seahy Oil Co. 2 Harmon, NE 5-8s-23e, which contains a fairly soft oil sand below a chert bed at the bottom of the well (Davis, Leon V., USGS, personal communication, 1958). The fact that the oil is found below a bed of chert suggests that the oil is indigenous to the Paleozoic rocks in which it is found. The age of the oldest strata penetrated in this well is not known, but its degree of induration and presence of a chert bed indicates that it belongs to the Paleozic-Ouachita facies.

"The intriguing question to be answered here, is how thick and what sort of sedimentary rocks are beneath the Lukfata."

Novaculite uplift—Area 4

Structure. The flanking formations of this uplift consist of a series of homoclinally dipping units, the youngest and most prominent of which is the very weather-resistant Arkansas novaculite. The novaculite in fact is so resistant that it forms an almost continuous rim around the lower, central, old-rock area. Near the center of the Novaculite uplift are found innumerable anticlinal hills of Crystal Mountain sandstone, none of which—so far as is known—has been tested for oil or gas.

Oil potential. Here also no one knows what kind of rock lies beneath the oldest exposed formation, in this area the Collier shale. The lowest exposed bed of the Collier is a 10-ft. bed of quartzose sandstone. Perhaps many more beds like this one lies beneath the exposed Collier and locally contains oil and gas. The intriguing possibility here is that if one of them should contain oil or gas, the productive potential of this large area of anticlinal hills indeed would be tremendous.

Acknowledgments

There are many ideas expressed in this discussion that are not original with the author. The oil and gas possibilities of the Paleozoic rocks of the Ouachita Mountains have been recognized and discussed for more than 30 years by geologists like Fath, Van der Gract, Powers, Harlton, Muir, Wilson, Farish, Howell, Lyons, Levorsen, Tomlinson, Hall, Fitts, Miser, Hendricks, and others. To them especially is owed the impetus that is finally yielding exploratory tests in the Ouachita Mountains. Many more are needed.

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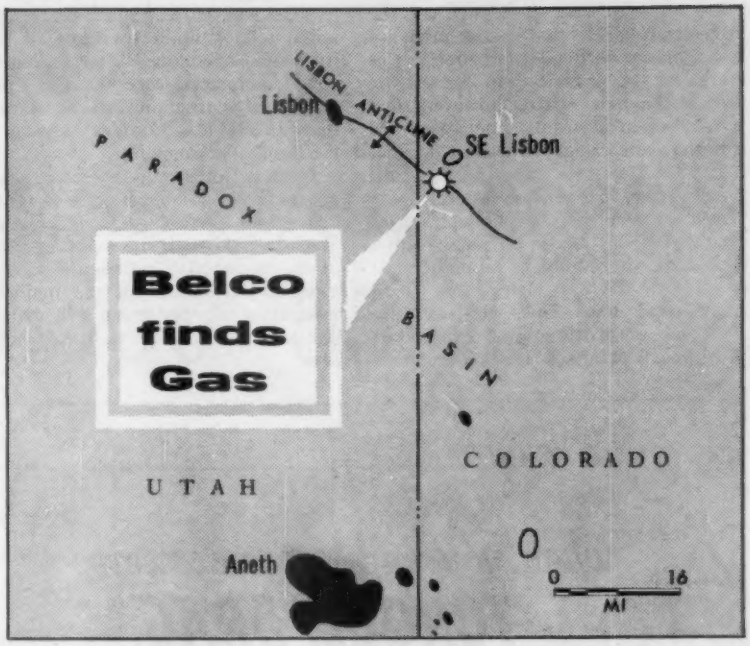

THE SOUTHEASTERN END of the Lisbon-Dolores anticline picked up a new Mississippian gas discovery, 2 miles southwest of Southeast Lisbon field.

SE Lisbon stretches southwest

SOUTHEAST LISBON, the gas-producing area at the southeast end of the Lisbon-Dolores anticline in the northern Paradox basin, was extended 2 miles to the southwest. Belco Petroleum Co. found Mississippian gas at the Egnar unit wildcat in C SE NE 30-44n-19w, San Miguel County.

Flow was 5,548 M.c.f.d. during tests of the Mississippian at 9,228-91 ft. This test is due to drill on to 9,500 ft. Location is 2 miles southwest of nearest production at Southeast Lisbon where Pure Oil Co. has both Mississippian and Devonian gas-condensate production. There are three shut-in wells in that field. A fourth Pure well is drilling in 31-45n-19w at 8,404 ft. in Paradox salt.

Lisbon. To the northwest at Lisbon in Utah, Pure will drill to 10,750 ft. at 1 LaSal-U.S.A. in NW NE 19-29s-24e, San Juan County. Well will go to the McCracken Devonian. It lies 5½ miles northwest of nearest production.

Saskatchewan adds thick oil pay

ONE OF CANADA'S foremost independents and a group of three American majors have come up with one of Saskatchewan's thickest oil sections to date.

Operated by Central Del Rio Oils, Lt., of Calgary on lands shared with Mobil Oil Co. of Canada, Ltd., Woodley Canadian Oil Co., and Sinclair Canada Oil Co., the well has encountered a gross pay thickness of nearly 85 ft. and while drill-stem tests are being withheld it is understood that clean oil was recovered on two of them which indicated the first 79 ft. of the pay sector as oil-bearing. During those initial evaluations no water was encountered. However, with the 85-ft. gross sector now opened it is understood that the water line has been penetrated. Production casing has been set in the well.

South Parkman. The test, Central Del Rio-MOWS 10-34-8-33 South Parkman, on LSD 10, 34-8-33w1, is 1½ miles south-southwest of Tilston oil production in Parkman field, and over 30 miles northeast of oil production in Steelman field.

New zone. The Tilston beds sector of the Mississippian, is itself a fairly new, potentially good, development sector. It wasn't until the team of Tidewater Oil Co., Central Del Rio Oils, Ltd., Union Oil Co. of California, and the British American Oil Co.,

Ltd., found what is known as the Parkman field, that much credence was placed on the Tilston zone in this area of the province. In comparison with the new strike, however, that initial discovery well cannot be classed in the same category. Drilled on LSD 2, 28-9-33w1, 4½ miles north of the new strike, that venture found a 10-ft. pay sector in the same horizon. Even at that it was placed on pump with a potential of 120 bbl. of oil daily.

Second try. This well was the second of a three-well exploratory drilling program undertaken by Central Del Rio on the group's lands. The initial test, 8 miles southeast of the strike was abandoned after failing to yield commercial success. The third well in the program will be started immediately; it is 11 miles due east of the South Parkman find.

Central Del Rio, as operator, holds an undisclosed interest with its associates, Mobil, Woodley, Canadian, and Sinclair. Although the exact interests of the parties have not been disclosed, Central Del Rio holds the majority interest in this particular well and in considerable acreage in the general area.

California wildcat staked

Richfield Oil Corp. is moving in equipment for a wildcat 1 mile northwest of San Emidio Nose field, Kern County, California.

The test, KCL Q-841-5, will test both the Reef Ridge zone found at about 11,500 ft. and the deeper Stevens zone found at about 12,700 ft. Richfield discovered San Emidio Nose in 1958 and has completed 20 wells in the field. Daily production averages about 6,500 bbl.

The wildcat is on a 1,760-acre block covered by an operating agreement among Richfield, Standard Oil Co. of California, and Westates Petroleum Co.

Another score in Sacramento

Atlantic Oil Co., Los Angeles exploration firm, has an apparent gas discovery in the Grimes area of California's Sacramento Valley.

The company's 1 U. E. Frye in 27-15n-1e, flowed at the rate of 3 M.M.c.f.d. through a ⅜-in. choke during a formation test at 6,400-40 ft. This is the upper section of the F zone.

Atlantic's well is 2 miles east-northeast of the 1 Sanborn, a new-pool discovery made in September by Cameron Oil Co. and Franco Western Oil Co. The Sanborn well tested 4 M.M.c.f.d. in the upper zone and 5,700 M.c.f.d. in the lower zone.

The operator will take the well to the lower zone, and last week was drilling ahead below 6,948 ft.

Driller hits near Ohio pool opener

In Ohio, Frank Walsmith moved about ¼ mile north of the pool opener in southwestern Pike Township, Perry County, and brought in another gasser, 1 Claude S. Barnes, Section 30. The Clinton sand had a natural gage of 285 M.c.f.d. at 3,273-3,308 ft. In a test 3 days after fracture it gaged 4,970 M.c.f.d. with a rock pressure of 730 psi.

• Wiser Oil Co. has a producer on a mile stepout in Rootstown Township, Portage County. The 1 A. Bersky, Lot 5, south of Ravenna pool, gaged 1,040 M.c.f.d. after fracture from the Clinton sand at 4,350-88 ft. Forty-eight-hour rock pressure 1,348 psi.

Across the township line in Edinburg Township, East Ohio Gas Co. reported completion of 1 A. K. Seyfried, Section 3. It gaged 536 M.c.f.d. and 20 bbl. of oil after fracture from the Clinton sand at 4,382-4,439 ft.

How one operator used D-Gassers to

reduce gas well costs by about $55,000

A Canadian operator — drilling deep gas wells in the Alberta foothills — is using the SWACO D-Gasser to save about $55,000 per well. Here is how he does it:

This operator, who was developing a gas field in the Alberta foothills, was encountering a gas-cutting problem during drilling that increased costs seriously. The problem was high-pressure, low-volume gas accumulations in a shale section above the main pay or between pay zones.

Until this shale section was reached, mud weight of 10 pounds per gallon was carried. When this section was being penetrated, however, severe gas cutting and "blowing" occurred. The gas cutting then persisted in the form of a two to three hour trip gas for the remainder of the well.

Practice before using D-Gasser

The operator circulated until he could build mud weight up to 11-13 pounds per gallon to control the gas cutting. Lost circulation in the pay section frequently occurred with the heavy mud, and a great deal of lost circulation material was often required. The cost of mud materials to control both gas and lost circulation ran $25,000 or more per well.

Initially, it took anywhere from two days to a week to condition the mud, and in one case it was necessary to set casing before drilling could proceed. In addition, several hours of rig time were lost after each trip gunning out the trip gas.

Practice when using D-Gasser

With a D-Gasser installed, the operator merely starts it up when the gas cutting occurs. Occasionally the preventers have to be closed, and the well placed on choke for a few hours. However, the whole job of mud conditioning can be accomplished in less than one day without increasing the mud weight. Moreover, penetration rates and bit life while drilling using the lower weight muds are substantially improved. Total savings in drilling costs amount to approximately $30,000 per well.

To summarize, the operator has found he saves $25,000 or more in mud costs and something like $30,000 in rig time and other drilling costs.

This case is just one of many examples that prove the SWACO D-Gasser is more than just a safety device to be used for wildcat drilling. It makes possible important reductions in overall well costs in any area where gas cutting is a problem. Contact your nearest SWACO representative to find out just how much D-Gassers can reduce your costs. Also ask him how SWACO Clayjectors and D-Sanders can further reduce drilling costs.

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New East Canada directory available at Port Credit

Eastern Gas & Oil Annual and Directory is now available from H. L. Akins Publishing Co., Ltd., Box 37, Port Credit, Ont., Canada. This publication includes an exploration and development section with illustrations and tables, a rundown on companies in the area that are engaged in various phases of the petroleum industry in East Canada. There is a map section showing all gas and oil fields onshore and offshore in the Lake Erie region of Ontario. There is also a special collection of detailed road maps.

The gas-distribution section shows current producing, gathering, and distribution status and future plans of Union Gas Co. There are feature reports on North Ontario Natural Gas Co., Lakeland Natural Gas, and St. Maurice Gas Inc.

Illinois basin gets new discoveries

AN UPSWING in Illinois basin exploration netted discoveries in Posey County, Indiana, and in Jefferson, Clay, and Jasper counties, Illinois.

Indiana. In Posey County, 6 miles southwest of Mount Vernon, Dr. Norbert Welch-F. E. Anderson & Son completed the 1 Rosa Lawrence in NE SE SW 5-8s-14w as a ¼-mile stepout discovery. The well flowed 240 bbl. per day, natural, from Aux Vases Mississippian at 2,670-88 ft.

One location to the north, William E. Hill 2 Basil Cox and Charles Bray, SE NE SW 5-8s-14w, flowed 20 bbl. of oil, natural, the first hour of tests through casing. It is now making 16 bbl. per hour from Aux Vases at 2,683-2,704 ft.

Illinois. In Jefferson County, Burrell G. Minor 1 Edna Johnson, SW SW SE 28-1s-3e, ½-mile stepout, 5 miles north of Mount Vernon, tested McClosky at 2,707-12 ft. The test at 2,705-14 ft. got 2,410 ft. of gas, 120 ft. clean oil, and 90 ft. of oil and gas-mixed mud A test at 2,695-2,708 ft. got 1,080 ft. of gas, 90 ft. clean oil, 30 ft. of oil-mixed mud and fresh mud.

Clay County. Leland Fulkerson completed 1 L. McAllister in NE NE NW 4-2n-7e, Clay County, on pump. The well made 192 bbl. per day after fracture of the Aux Vases through perforations at 2,956-62 ft. Location is 1½ miles from production, 2 miles southeast of Flora.

Jasper County. F. M. Minor 2 W. L. Parr is on pump for McClosky tests at 2,540-45 ft. Location is 5 miles northeast of Newton in NE SE NE 14-7n-10e. The well swabbed 14 bbl. of oil per hour earlier.

Dual production tapped at Kansas wildcat

Dual-zone production is reported at a wildcat in Kansas' Sedgwick basin. Discovery is H. H. Blair 1 Ketteman in SE SE SW 2-27s-2e, ½ mile north of dry Northwest Minneha Simpson oil field.

The Sedgwick County wildcat recovered 40 ft. of free oil and 70 ft. of heavily oil-cut mud at 3,260-82 ft. in the Simpson Ordovician. An Arbuckle test at 3,286-94 ft. got 410 ft. of oil and 70 ft. heavily oil-cut mud.

Haskell County. Cities Service Oil Co. opened Lansing-Kansas City Pennsylvanian oil production in southwestern Kansas at 1 Blair "B," C SE NW 32-30s-33w.

The well flowed 456 bbl. of oil daily from perforations at 4,128-38 ft. Location is 3 miles southeast of Sa-

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tanta and about 2 miles northwest of Hopkins Mississippian oil field.

Barton County. Nadel & Gussman are taking production tests at a new Arbuckle Cambro-Ordovician discovery 1¼ miles southeast of Redwing field.

The 1 Eveleigh "B," N½ NE NW 8-18s-12w, has indication Lansing oil production at 3,122-78 ft. Location is 5 miles east of Hoisington, Kan.

Rooks County. John O. Farmer Inc. 1 Collins, N½ SW SE 34-9s-18w, 2 miles east of North Williams field and 1½ miles southeast of Paradise Creek field in Rooks County, recovered 100 ft. of free oil and 50 ft. muddy oil on a drill-stem test in the Simpson sand at 3,643-60 ft. Location is 1 mile southwest of the town of Plainville.

Stevens County. New Council Grove Permian gas wells were completed in Panoma gas field by Anadarko Production Co. Both are located in 312-39w. The 1-25 Simmons "B," C SW 25, flowed 1,580 M.c.f.d. from perforations at 2,772-2,854 ft. The 1-35 Youngren, C NW 35, flowed 1,550 M.c.f.d. from perforations at 2,768-2,887 ft.

Michigan offsets drilling

In Michigan, Bell & Gault 1 Young NE NE NW 11-8s-1w, Wright Township, Hillsdale County, completed last month for a 25-bbl. pumper discovery in the Prairie du Chien at 3,466 ft. is starting to attract followup action. Offsets to the west and northeast are drilling and five wildcats, 3 or more miles out, are drilling or staked.

The play is 15 miles southeast of the south end of the Albion-Scipio trend.

McClure, Covey, & Null 1 Grundemann, SW SW NW 33-3s-3w, Concord Township, Jackson County, wildcat 3 miles northeast of Pulaski field, swabbed 2 to 6 bbl. oil a day over 4-day period at 3,880-90 ft. after 10,000-gal. acid treatment. Trenton top logged at 3,845. Originally test was drilled to 4,519 ft. through the Trenton and Black River and then plugged back to 3,910 ft.

While still in the questionable stage as a commercial well, the wildcat is the first on the east side of the Albion-Scipio trend to show oil in any amount.

Second well added to Kingfisher trend

The second producer is reported in the northern extension to booming Kingfisher County's Mississippian trend. Marion Oil Co. completed 1 Valtr-A northeast of Kingfisher County's East Hennessey field flowing 28 bbl. of oil per hour through 20/64-in. choke.

Production is from Meramec lime in open hole at 6,438-6,526 ft. The first well had production from both the Cleveland Pennsylvanian and the Meramec.

Old New Mexico hole flows Wolfcamp in Eddy

An old 8,304-ft. hole in eastern Eddy County, Southeast New Mexico, was reentered to uncover good flowing production in the Wolfcamp Permian. New discovery is John H. Trigg 1-20 Sivley-Wright in 20-18s-29e, 1 mile southeast of Artesia field and 7 miles south of the town of Loco Hills.

The well flowed 116 bbl. of 40.1°-gravity oil per day on its potential test through ½-in. choke. Perforations were at 8,686-97 ft. The operator had taken the well to 12,160 ft., then plugging back to 8,786 ft. for completion. Tops included Wolfcamp at 8,598 ft., Pennsylvanian at 9,607 ft., Mississippian at 11,500 ft., Woodford 12,022 ft., and the Devonian at 12,076 ft.

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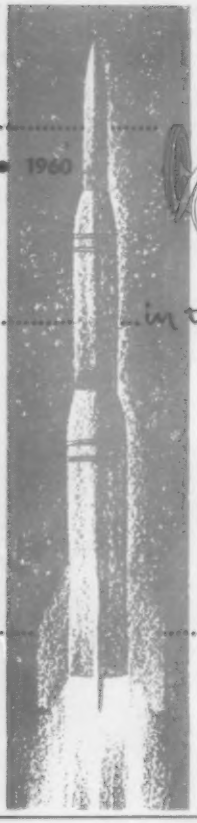

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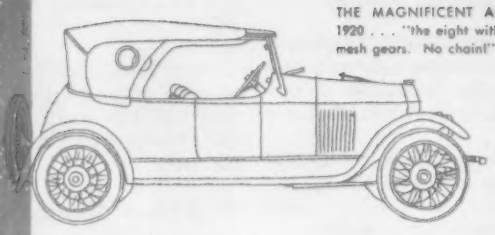

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covery was completed 49 miles west of Hobbs in southwestern Lea County.

New pool-opener is El Paso Natural Gas Co. 1 Lusk Deep unit in 19-19s-32e, ½ mile northeast of Lusk-Delaware field. The well is a dual producer in Bone Spring and Strawn. From Bone Spring perforations at 8,759-77 ft. the well flowed 141 bbl. of oil per day, 39° gravity, through 9/64-in. choke. From Strawn perforations at 11,168-93 ft. it made 732 bbl. daily, natural, through ¼-in. choke. There is no nearby deep production.

Field extension well completed in North Dakota

An extension to Flaxton field in Burke County, North Dakota, was completed last week flowing 500 bbl. per day.

The good well is Simcox Oil Co. 1 Lind-A in C NW NW 32-163n-90w. Production is from a notch in the Madison Mississippian at 5,818 ft. This is the south offset to production in the southeastern part of Flaxton field and is just north of the town of Flaxton.

Second well finaled in new Pecos County field

The second oil well in new Waha Delaware field, Pecos County, far West Texas, is Sun Oil Co. 2 J. D. Hodge, Section 7, Block C-3, PSL Survey.

This new producer flowed 207 bbl. of 40.8°-gravity oil plus 18 bbl. of water in 24 hours through ¼-in. choke from perforations at 4,912 to 4,994 ft. Location is 29 miles northwest of Fort Stockton. The well is the southeast offset to the field discovery.

Northwest Oklahoma has new Cherokee field

A new Cherokee Pennsylvanian sand gas-condensate field was opened in Woods County, northwestern Oklahoma. Discovery well is Panhandle Development Co. 1 Urban in C SE NW 35-26n-17w.

Open flow was 5,500 M.c.f.d. and 17 bbl. condensate per million. Perforations were at 5,837-47 ft. The first offset in this new producing area is 1 Urban in C NE SW 26-26n-17w.

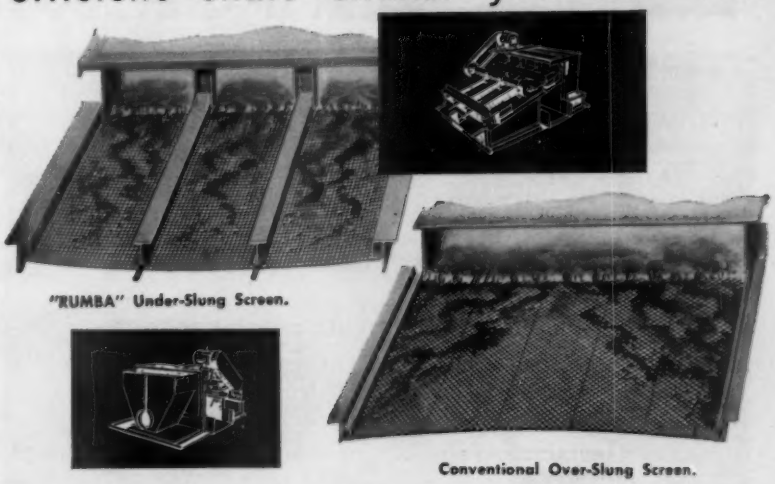
Arkoma basin. Two more deep wildcats were announced for southeastern Oklahoma's Arkoma basin region.

Mobil Oil Co. will drill a deep one near the old Quinton shallow gas field in Haskell County. The 1 Quinton unit, C SE NE 11-7n-19e, will go to 6,200 ft. Ambassador Oil Corp. 1 Scott, NE SW 27-8n-20e, will drill to 6,250 ft. Both will test the basal Atoka and Cromwell Pennsylvanian sands.

Dual discovery. Herman Brown 1 Kunkler, SW SW SW 24-9n-1w, Cleveland County, northeast of the city of Norman in Central Oklahoma, flowed 195 bbl. of oil per day through 12/64-in. choke from perforations in the second Wilcox Ordovician sand at 6,748-58 ft. Oil Creek Ordovician at 7,422-45 ft. was good for 240 bbl. of oil daily through 10/64-in. choke. A southeast offset try, the 1 Walker, NE NW NW 25-9n-1w, is drilling below 7,000 ft.

Triple completion. The Joiner City area of Carter County in southern Oklahoma has a triple-zone well. Humble Oil & Refining Co. 1 State-Churchill, SE SW NE 34-4s-3w, flowed 390 bbl. of oil per day through 42/64-in. choke from Chimney Hill Siluro-Devonian perforations at 5,652-74 ft. Upper Bois d'Arc at 6,300-92 ft. was good for 700 bbl. per day through ½-in. choke, while the lower Bois d'Arc was good for 702 bbl. per day through perforations at 6,762-89 ft. through 30/64-in. choke.

here's why "RUMBA" is the most efficient shale shaker you can own



"RUMBA" Under-Slung Screen.

Conventional Over-Slung Screen.

"RUMBA" is the only shale shaker that evenly distributes the drilling fluid over the entire screening area. This gives you a more effective separation of cuttings with a high rate of flow.

"RUMBA" is the only shale shaker equipped with an under-slung screen cloth. The heavy steel struts above the screen: 1) Provide 20 lineal feet of rigid driving surface; 2) Prevent whipping or flexing of the screen; 3) Control distribution of drilling fluid over the screen.

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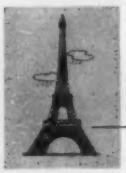

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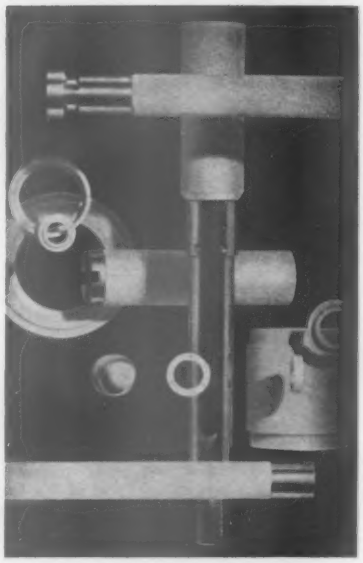

Leading Oil Field Pump Manufacturers Use Coors Alumina Ceramics to Fight Abrasion

Leading pump manufacturers are supplying plungers of Coors Ceramic, because they wear several times longer than plungers of expensive metals.

Coors Alumina Ceramics are extremely hard—equal to a sapphire in hardness. This property makes the plungers very resistant to abrasion. The ceramic is virtually inert to chemicals—it does not corrode nor pit in service. It has a tensile strength of 17,000—18,000 PSI and a compressive strength of over 240,000 PSI.

Coors Alumina Ceramics are also used for rock bit nozzles, chokes, ball check valves, and sleeve protectors for multiple completion wells.

Chokes of Coors Ceramics are available through oil field stores. Pump plungers and other ceramic parts are available only through equipment manufacturers. If you are having abrasion or corrosion problems, ask your equipment manufacturer about Coors Alumina Ceramics!

Coors
Alumina Ceramics
COORS PORCELAIN COMPANY
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Two new wells are staked. The 1 Woodworth-Jones in SE SW SE 34 and the 1 Woodworth Estate in SE NE SE 34.

Formation evaluation to be studied in Houston

A formation-evaluation symposium will be held in Houston, November 21-22, sponsored by the Gulf Coast section of AIME, the University of Houston Student Chapter AIME, and the Department of Petroleum Engineering of the University of Houston. This symposium is the result of a year-long Gulf Coast section program search. It was decided that the rapid advance of formation-evaluation techniques in the past few years needed serious study. From this base a program committee set to work with a unique approach—write an ideal program to cover the field, and then ask recognized authorities on the topics to write and present the papers.

Mississippian discovery finaled in North Texas area

New Mississippian production was opened at a wildcat in Jack County, North Texas. Discovery well is Burns Trust 2, 3 miles northwest of Antelope. The well, 1 Garrett "A," was completed through open hole with top of pay at 5,647 ft. flowing 168 bbl. of oil per day through 10/64-in. choke. Location is in the BBB&C Survey, 2,000 ft. northwest of Tex-Am Strawn field and 3½ miles southeast of nearest Mississippian oil at W.G.S. Mississippian field in the southeast corner of Archer County.

Texas' Wharton adds five new discoveries

DENSELY EXPLORED and productive Wharton County, on the Texas Gulf Coast, has come up with at least five more discoveries in a succession of new oil and gas fields opened this year.

Latest is an oil discovery by Houston Natural Gas Co. a mile southwest of Duffy field, in the southern part of the county. There the discovery well, 1 Ella Wiggington, flowed 163.64 bbl. of 44.2°-gravity oil daily through 8/64-in. choke from Frio sand at 7,547-52 ft. Gas-oil ratio was 710 cu. ft. per barrel and pressure of 1,275 psi.

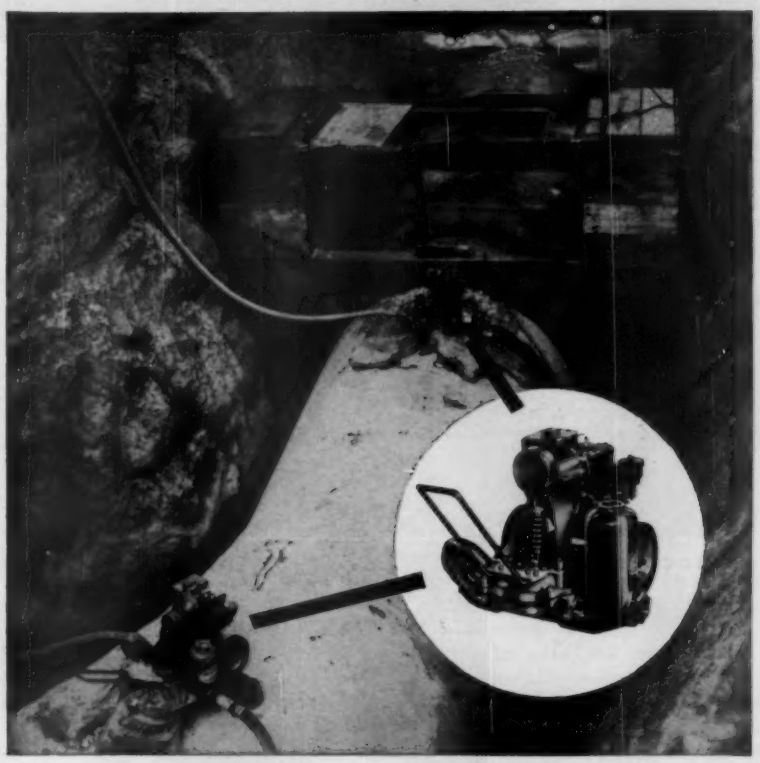
Acco Oil & Gas Co. has accounted for two of the late new discoveries. One is a dual-zone discovery, located 10 miles northwest of El Campo. Nearest production is in North Louise field, 4 miles southeast. Discovery well, 1 William Schmidt, is rated at 4,200 M.c.f.d. from Frio sand at 4,259-66 ft., and 2,800 M.c.f.d. from a shallower Frio zone at 4,059-66 ft. Gas is dry.

The other Acco discovery is in its 1 Marie Krotky unit, 3 miles west of East St. Bernard, and ¾ mile northwest of production in East Bernard field, in the northeastern part of the county It is productive of gas and condensate from Yegua sand at 7,720-28 ft. Flow through 10/64-in. choke was at the rate of 1,334 M.c f.d. of gas with gas-liquid (55°-gravity condensate) ratio of 67 M.c.f. per bbl. Flowing pressure was 2,185 psi.

Location of this well is about a mile east of a recent gas-condensate discovery by R. J. McGalliard that extended production of East Bernard field 2 miles southwestward. The latter discovery well, 1 Leveridge, is productive from Yegua sand at 7,495-7,523 ft.

William K. Davis has a new dry-gas discovery a mile north of Pickett Ridge field where his 1 C. Wilbeck has been completed in Frio sand at 5,649-52 ft. Open-flow potential is rated at 15,755 M.c.f.d. Flowing pressure through 12/64-in. choke with flow of 1,701 M.c.f.d. was 1,944 psi. Location is a mile north of Pierce.

57 DIAPHRAGM PUMPS ON THIS JOB...AND 47 ARE GORMAN-RUPP



The Brea (California) pipeline job consists of 14 miles of 96" cement-coated steel pipe. Diaphragm pumps were selected because they can be easily moved from bell joint as the welders progress. Contractors: Morrison-Knudsen, Inc. and Macco Corp. of Los Angeles.

Gorman-Rupp Diaphragm pumps are by far the favorite of contractors. These exclusive features show why: diaphragm drive rod spring-cushioned on down-stroke; suction accumulator for smooth pumping flow; antifriction, helical-ground gears and bearings operate in oil; one-man handling, engine-driven 3" pump only 120 lbs., job-to-job.

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Rockets help survey of offshore acreage

(Photos and information courtesy The Houston Pecten.)

A "FIRST" in oil-industry offshore operations was recently rung up by Shell Oil Co. by using specially designed rockets as a sight-in guide in a night-time visual survey of the company's first test well on Texas offshore acreage acquired through federal leases last February.

Previously, helium balloon flares, more difficult and more apt to err, were used by night surveyors.

A SURVEYOR FOR SHELL OIL CO., P. M. Walters, launches a rocket from a gun near Galveston. Three survey teams take simultaneous readings several miles away on the burst, to establish the geodetic location of Shell's first well on Texas federal offshore leases.

A ROCKET explodes over the Gulf of Mexico, 31 miles south of Galveston.

SIGHTING on the rocket is this survey team on top of the Buccaneer Hotel in Galveston. They are C. W. Fisher, left, and R. E. Collins, land-surveying and drafting division of Shell Oil Co. This is one of the three points on which survey teams were stationed to take simultaneous readings.

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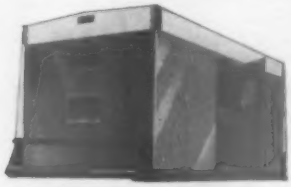
"Knock-Down" units are quickly erected with a minimum of labor. Side walls, mounted on continuous hinges, simply raise into place. End walls are bolted into side walls and frame. Fiberglass roof is one-piece construction.

Elder designs and builds all types of mobile housing for field crews.

Knock-down unit ready for setting up.

Side walls go up first.

End walls and roof are locked securely into place.



Unit erected.

Eight knocked-down units loaded and ready for shipment.

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DENVER PLANT: 4830 Race Street, Phone AMherst 6-1781
HOUSTON PLANT: 4510 Navigation Blvd. Phone WAlnut 6-8335

Site chosen. The drilling site chosen for the wildcat is located in Federal Block OCS-288, 31 miles south of Galveston. The Buccaneer area, a Shell label, is 3 miles square, covers 5,760 acres, and is under 65 ft. of Gulf of Mexico water.

No surface aids. There were no surface features offshore to help Shell's surveyors get their bearings.

The underwater site had to be determined in relation to fixed points along the shore. The test-well location was first staked electronically by the Marine Exploration Division by means of an electronic system known as "Raydist." To satisfy the Bureau of Mines requirement for a geodetic position of the well site, Land Department personnel then conducted a visual survey before bringing in the drilling rig.

Due to distance from shore and dropoff, the well location is not visible from land. A daylight survey was impractical. To make the night location, two survey teams were stationed at different points along the shore. After first determining the geodetic position of a specific point on a Pure Oil Co. well platform in the Gulf, a third team was stationed on the platform. A boat with a rocket-firing crew was then sent to the "Raydist" location.

Special rockets. Specially built rockets that would reach to more than 700 ft., then explode a parachute-suspended flare capable of burning for about 30 seconds, were ordered by the land department. Simultaneous readings on the flares were taken by the survey teams as the rockets were fired.

Highly satisfactory. Shell is highly pleased with the results of its night rocket survey. Easier to use, cheaper, and more accurate than previous methods, rockets give every indication of becoming a valuable friend to underwater exploration men.

Discovery wells

TEXAS GULF COAST

Victoria County:

Edwards, Ford & Hamilton 1-Section 2 R. H. Welder Heirs, Section 2 SA& MG Sur., A-427, 6 miles northeast of Nursery. AOF 17,200 M.c.f.d., GLR 43.48 M.c.f. per bbl., 55.4°, shut-in TP 2,953 psi., perf 8,485-8,526.5 ft., Wilcox. TD 8,700 ft. New pay in Southwest Helen Gohlke field.

Harkins & Co. 1 K. O. Lassman, Eben Haben Sur., A-58, ½ mile north of Mission Valley. AOF 62 M.M.c.f.d., dry gas, shut-in TP 1,522 psi., perf. 3,628-32 ft., Vicksburg. TD 9,116 ft. New reservoir discovery in Dreyer-Mission Valley area.

Logue & Patterson 1 A. J. Bankhead, Block 39, Roseborough Ranch Subd., Fernando de Leon Sur., A-67, 5 miles southeast of Inez. IP 102 BOPD, ⅛-in., 41°, GOR 706 cu. ft. per bbl., TP 660

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psi., perf. 5,860-62 ft., Frio. TD 6,715 ft. New-field discovery—South Witte.

Wharton County:

R. J. McGalliard and John R. Sparks 1 W. C. Leveridge et al., 3 miles west of East Bernard. AOF 800 M.c.f.d., GLR 48.6 M.c.f. per bbl., 49.8°, shut-in TP 2,791 psi., perf. 7,495-7,523 ft. TD 7,851 ft. Extends East Bernard field 9,500 ft. southwest.

WEST CENTRAL TEXAS

Haskell County:

Fletcher Oil & Gas Drilling Corp. 1 O. E. Oakes, 5 miles northwest of Haskell in Subd. 14, Coryell CSL Sur. 72. IPP 114 BOPD, 40°, Burson sand 4,862-68 ft. TD 4,958 ft New oil field.

Shackelford County:

Coastal States Gas Producing Co. 1 E. D. Fincher, 8 miles north of Albany in Sec. 527, TE&L Sur. IPP 15.6 BOPD, plus 7% water, 39°, GOR 275:1. Lime 4,610-46 ft. TD 4,666 ft. New oil discovery.

Taylor County:

Coastal States Gas Producing Co. 1 Henry Sayles, Jr., 8 miles southwest of View in Sec. 9, GC&SF Sur. IPP 45 BOPD, plus 32% water, 37°, GOR 175:1, Flippen sand 2,658-62 ft. TD 2,814 ft. New oil discovery, prorated in Regular field.

WEST TEXAS

Coke County, South Bloodworth 5,600-ft. Cany field:

Coastal States Gas Producing Co. 1 J. B. Walker, 5 miles south of Silver in W. R. Walker Sur. 18, A-1828. IPF 156 BOPD, 45°, 20/64-in. choke, Cany sand 5,593-97 ft. TP 190 psi. CP 590 psi. TD 6,650 ft. New oil discovery.

Crockett County:

Santiago Oil & Gas Co. 1 Davidson, 12 miles south of Ozona, Sec. 21, Blk. F., GC&SF Sur. IPCAOF 28,500 M.c.f.d., Strawn 8,912-9,046 ft. TD 9,760 ft. PBTD 9,218 ft. New gas pool.

Ector County:

Anderson-Prichard Oil Corp. 1-14 Fasken unit, 14 miles north of Odessa in Sec. 14, Blk. 42, T-1-N, T&P Sur. IPF 189 BOPD, 14/64-in. choke, 41°, GOR 1,146:1, TP 844 psi., packer, Wolfcamp 8,475-95 ft.; IPF 351 BOPD, 15/64-in. choke, 48.1°, GOR 1,676:1, TP 1,105 psi., packer, Fusselman 12,220-50 ft.; IPF 440 BOPD, 18/64-in. choke, 53.6°, GOR 964:1, TP 1,265 psi., packer, Ellenburger open hole 12,986-13,019 ft. TD 13,019 ft. Triple oil discovery.

McGrath & Smith 2 A. B. Connell, 4 miles southwest of Penwell in Sec. 8, Blk. B-16, PSL Sur. IPP 143 BOPD, plus 140 BWPD, 36°. GOR 1,325:1. Tubb 5,292-5,302 ft. TD 5,925 ft. New oil discovery.

Garza County:

General American 1-64 Miller, 8 miles southwest of Justiceburg in Sec. 64, Blk. 6, H&GN, Sur. IPF 264 BOPD, 12/64-in. choke, 29.6°, GOR 825:1 psi., CP 325 psi. Strawn 7,706-17 and 7,779-90 ft. IPF 212 BOPD, 12/64-in. choke, 40.6°, GOR 5,751, TP 800 psi., packer, Ellenburger 8,158-70 ft. TD 8,172 ft. Dual oil discovery.

Howard County:

Camp Oil Co. et al. 1 R. T. Schafer, 3 miles northwest of Vincent in Sec. 28, Blk. 25, H&TC Sur. IPF 185 BOPD, 24/64-in. choke, 42°, GOR 1,160:1, TP 140 psi., CP 690 psi. Penn reef open hole 7,493-7,503 ft. TD 7,503 ft. New oil discovery.

Martin County, Breedlove field:

Jake L. Hamon et al. 1 W. M. Yates, 6 miles southwest of Patricia in Lab. 21., Lge. 263, Kent CSL. IPF 37 BOPD, 32/64-in. choke, 38.7°, GOR 1,390:1. Wolfcamp 10,074-84 ft.; IPF 438 BOPD, 8/64-in. choke, 41.8°, GOR 125:1, TP 1,000 psi., packer. Devonian open hole 12,008-12 ft. TD 12,012 ft. New dual oil discovery.

Pecos County:

Bernard Esunas 1 M. B. Monroe, 4 miles north of Shefield in Sec. 40, Blk. 1, I&GN Sur. IPP 63 BOPD, 32°, Queen 1,530-42 to 1,610 ft. TD 2,050 ft. New oil discovery.

Sterling County:

Johnson & Grobel 1 Hildebrand-Foster, 3 miles southeast of Sterling City in Sec. 21, Blk. 12, SPRR Sur. IPP 2 BOPD, 36°, Yates sand open hole 496-531 ft. TD 531 ft. New oil discovery.

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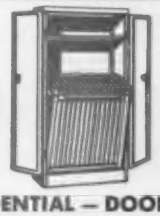
MAP  FILE

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Beardmore Measures Up

. . . to honor of holding first petroleum degree from a famous school. At Gulf, he favors "thinking big."

HERBERT F. Beardmore was the first man to receive a petroleum degree from the University of Oklahoma's famed petroleum engineering school—and he's been measuring up to this distinction ever since.

Today Beardmore presides over all domestic exploration and production for Gulf Oil Corp., bears the title of vice president, and holds a certificate from his fellow petroleum engineers for "outstanding achievements."

Beardmore's elevation to a Gulf vice presidency last month proved that officials of companies absorbed by industrial giants are not lost in the shuffle. He had been a vice president in charge of Warren Petroleum Corp. oil operations.

Beginnings . . . Ohio-born but Oklahoma-reared, 56-year-old Herb Beardmore has seen a lot of oil history in the making.

After attending Oklahoma City public schools, he entered the University of Oklahoma and enrolled in the new engineering geology school, the predecessor to the petroleum engineering school. Of the 42 engineering graduates from O.U. in 1925, he was the only one who had taken the petroleum courses.

His first oil-field job was as a roustabout at Ranger, Tex., with an energetic young independent named Jake Hamon, later chairman of the American Petroleum Institute.

Beardmore went to Bartlesville in 1926 as a gas engineer for the old Indian Territory Illuminating Oil Co., and 3 years later had the good fortune to be assigned to the new Oklahoma City field and to study the gas flow of ITIO's wild Mary Sudik well. It was here that the young engineer began to build his reputation as an expert in high-pressure gas, in gas lifting of crude, and in handling of drilling muds.

He joined Amerada Petroleum Corp. in 1935 as district engineer at Seminole, Okla., and 4 years later moved to Tulsa with wider responsibility. Barnsdall Oil Co. tapped him as chief engineer in 1943 at Tulsa, a job he held another 4 years.

Milestone . . . Then came one of the real challenges in Beardmore's life. Warren Petroleum asked him to move to Houston to be the operating chief of drilling and production.

"I walked into a bare office at Houston," he recalls. There wasn't even a place to hang my hat but the door knob."

Warren, a Tulsa concern specializing in casinghead liquids, had very little crude production in 1947. But by the time Warren was absorbed by Gulf in 1955, its production was 17,000 bbl. per day and Beardmore was vice president of the oil division.

Warren continued to operate independently for 2 years until the oil activities were absorbed by Gulf in late 1957.

"And I got absorbed along with it," Beardmore said.

Gulf immediately assigned Beardmore as the Houston district manager and then, upon the retirement of Robert L. Boggs last month, promoted him to the top spot in domestic exploration and production.

The job . . . Beardmore took over 4,000 employes, 20,000 wells, and 330,000 bbl. daily production at a crucial time in Gulf's history.

The company has just completed a decentralization program in which domestic operating headquarters were moved from Pittsburgh to Houston. Beardmore approves this change because operating people "really get to operate" when separated from top policy personnel.

Beardmore has his work cut out for him. Gulf wants more production, but it wants to produce more cheaply.

As for finding new oil, Beardmore sees South Louisiana and Offshore Louisiana as the chief frontier, but new opportunities are virtually everywhere.

"We must be creative, and we must think big," he says. "Gulf will provide the money, and we probably will drill more next year than this year. A lot of people are pessimistic that we'll be in a tight situation for many years, but I believe that, with increased demand, the situation is not as bad as it might look."

The man . . . Beardmore is proud that not only his company but also his fellow engineers have given him recognition.

Just last month the Society of Petroleum Engineers of AIME awarded him its "Certificate of Service" award for his work in the organization. He was the SPE national chairman in 1946.

Beardmore is serving this year as president of the Petroleum Club of Houston.

●

Dr. John A. Hedge has joined Sun Oil Co.'s basic-research division in Wilmington, Del., as a research chemist.

John Ed Cooper, BBM Drilling Co., Houston, has been elected 1961 chairman of the Permian Basin chapter of American Association of Oilwell Drilling Contractors. **Guy B. White,** Delta Drilling Co., Tyler, Tex., has been elected chairman of AAODC's Ark-La-Tex chapter.

NEW AAPG officers, Pacific section are, left to right: Hester, Faggioli, Schwade, and Patterson.

Exploration Groups Name New Officers

Irving T. Schwade, Richfield Oil Corp., has been elected president of the Pacific section of the American Association of Petroleum Geologists.

He succeeds Thomas A. Baldwin, Monterey Oil Co. Schwade's election was announced at the joint meeting of AAPG, Society of Exploration Geophysicists, and Economic Paleontologists and Mineralogists.

The new SEG president for the West Coast is Bart W. Sorge, United Geophysical Co., who succeeds Forrest F. Lambrecht, Texaco Inc. Edwin H. Stinemeyer, Shell Oil Co., has been named SEPM president succeeding Weldon Rowe.

Other new Pacific Coast AAPG officers are: Richard E. Faggioli, Humble Oil & Refining Co., vice president; Robert O. Patterson, Pacific-Oil Well Logging, secretary; and Richard L. Hester, Pauley Petroleum, Inc., treasurer.

Also elected by SEG are: Marc O. Miller, Continental Oil Co., southern district vice president; Allen J. Garber, Jr., Texaco, northern district vice president; Roy R. Farnsworth, Shell, secretary - treasurer; and William O. Murphy, Jr., Standard Oil Co. of California, editor.

William J. Lewis, Standard of California, has been elected secretary-treasurer of SEPM.

Allan B. Fullerton, production engineer for Pure Oil Co. in Oklahoma City, has been transferred to Moab, Utah.

John Maher, president of Reed Roller Bit Co., has resigned, and **Ray O. Shaffer,** chairman, temporarily will assume the additional duties of president and chief executive officer. Both Maher and Shaffer became officers of Reed in August 1958. Maher will remain on the Reed board. He resigned as president in order to devote full time to his ranching interests in South Texas.

E. C. Hadlock, head of the alcohol group in chemical technical-service at Humble Oil & Refining Co.'s Baton Rouge refinery, has been transferred to the Baton Rouge chemical-products laboratory as head of the chemical-problems group. **S. B. Reynolds** will succeed Hadlock in chemical technical-service.

Gifford H. Symonds, operations research coordinator for Humble Oil & Refining Co.'s Esso Standard division in New York, has retired after 31 years with the company. He will become associate professor of management at Case Institute of Technology, Cleveland, after retirement.

Marvin E. White, central district industrial sales manager for Ohio Fuel Gas Co., has been promoted to manager of industrial sales for the company. He succeeds **Charles C. Eeles,** who recently was transferred to Columbia Gas System Service Corp. in New York.

▶▶▶ Personals

M. W. Hunt has been promoted to research chemist in Continental Oil Co.'s petroleum-products research division.

Ben F. Brown has been named a shift superintendent at Union Carbide Chemicals Co.'s Brownsville, Tex., petrochemical plant. Brown had been shift foreman at the Texas City plant.

J. T. Wooten, former chief engineer of Mississippi River Fuel Corp., has joined Transwestern Pipeline Co. as chief engineer. **J. H. Cretsinger,** consulting engineer with Butler, Miller & Lents, has joined Transwestern as head of the reserve and deliverability section. **Armando de Leon** has been named administrative assistant to **William B. Padon,** Transwestern vice president. De Leon had been supervisor of wage and salary administration for Warren Petroleum Corp.

Howard L. Holder, senior engineer with El Paso Natural Gas Co., has been named chief process engineer. He succeeds **O. R. (Randy) Clements,** who recently was transferred to El Paso Natural Gas Products Co. In other changes, **Alfred O. Shiplet** has been named gas production engineer in Jal, N. M. He was formerly chief field dispatcher. **John E. Lynch,** assistant station superintendent at the southern division's Pecos River station, has been promoted to station superintendent. **Jack W. Alison,** assistant station superintendent at the Guadalupe station, has been promoted to superintendent of the Benson, Ariz., station.

M. C. Easterling has been named coordinator of sales in Gulf Oil Corp.'s new Toledo marketing division. **H. D. Minnich** has been named superintendent of supply and field services there. **R. E. Ballard** has been named supervisor of dealer and sales training, and **J. P. Liebhern** has been named supervisor of office services, Toledo.

Samuel W. Horsfield, vice president of Long Island Lighting Co., has retired after 33 years with the company. Horsfield received American Gas Association's Award of Merit for contributions to the group's operating section in 1953. He is also a past winner of AGA's Beal Medal for best technical paper of the year in 1948.

Guy B. Heflin, senior engineer with El Paso Natural Gas Co. in El Paso, Tex., has joined Colorado Interstate Gas Co. in Colorado Springs, Colo., as project engineer.

▶▶▶ Personals

Dr. William E. Bonnet has been named manager of economics and planning, a new position, in Sun Oil Co.'s commercial-development division, research and engineering department. **Dr. Donald F. Rugen** has been

BONNET

RUGEN

named manager of market analysis, commercial-development division, also a new position. Bonnet had been technical assistant to the director of research. He will be succeeded in this post by **Walter B. Patterson, Jr.** Rugen joined Sun last year as research chemist in research and development.

E. W. Nommensen, section head in the crude and product-coordination department at Humble Oil & Refining Co.'s Baton Rouge refinery, has been named assistant head of the process-engineering department. **E. T. Craig,** assistant head of the petroleum technical-service department, will succeed Nommensen. **J. W. Rector,** assistant head of petroleum technical-service, will assume full responsibility as assistant head of that department. In other changes at the refinery, **J. T. McMillan,** engineer in petroleum technical-service, has been transferred to process engineering. **R. J. Shirley,** engineer in the mechanical-engineering department, has moved to petroleum technical-service. **B. W. Brabston,** engineer in mechanical engineering, has moved to the chemical technical-service department.

John B. (Jack) Lawrence, gas process engineer with Mobil Oil Co. in Oklahoma City, has been transferred to Beaumont, Tex., as senior process engineer for Mobil Chemical Co.

Mike Pappas, general process superintendent at the Lima, Ohio, refinery of Standard Oil Co. (Ohio), has been given a 6-month assignment in the refinery-engineering unit in Cleveland.

Roy C. Beversdorf has been promoted to principal staff engineer in the general engineering department of Standard Oil Co. (Ind.) at Whiting, Ind. Seven men have been promoted to senior staff engineer in general engineering, Whiting. They are **Rudolph W. Wendes, Donald G. Salanty, Dale R. Ream, Raymond F. Mottet, Irwin W. Key, Robert J. Gallenbach,** and **Richard J. Eisenach.**

J. L. (Slatz) Latimer, senior vice president of Mobil Oil Co. and chairman of Magnolia Pipe Line Co., will retire January 1 after 45 years with Socony Mobil companies. Latimer joined the old Magnolia Petroleum Co. as a loading-rack helper in 1915. By 1938, he was a director and vice president of Magnolia Petroleum and Magnolia Pipe Line. He was elected president of both companies in 1946 and became chairman of the pipeline company in 1952. When domestic operations of Socony Mobil were consolidated last year, Latimer became senior vice president of Mobil Oil Co.

D. L. Potter, superintendent of Canadian land and geological operations in Calgary for Phillips Petroleum Co., has been appointed Pacific-Asiatic geological coordinator in the international department's exploration and production division. He will headquarter in Bartlesville, Okla. **L. M. Rickards,** division geologist in Venezuelan operations, has been named chief geologist in Venezuela. **J. W. Henderson,** chief geologist for Canadian operations since 1950, has been transferred from Calgary to Madrid, Spain, where he will be Spain-Spanish Sahara exploration director for Phillips Oil Co., a subsidiary.

POTTER

Kurt H. deCousser, Michigan resident geologist and production manager for Mobil Oil Co., will retire December 31. Mobil plans to close its Michigan production division and will sell properties in the state.

Warren Bradford, process foreman at the Lima, Ohio, refinery of Standard Oil Co. (Ohio), has been named senior technical specialist in the Cleveland home office. **Darrell Lehman,** operation foreman at the Lima refinery, has been promoted to process foreman. **Thomas Watt,** operation foreman, Lima, has been named assistant process foreman.

INSTALLED at last week's annual meeting of Society of Exploration Geophysicists in Galveston were new officers, left to right: T. O. Hall, General Geophysicial Co., past president; John C. Hollister, Colorado School of Mines, Golden, first vice president; Dr. John P. Woods, Atlantic Refining Co., Dallas, president; Robert C. Kendall, Shell Oil Co., Denver, first vice president; and Francis A. Hale, California Standard Co., Calgary, secretary-treasurer.

Personals

E. L. Petree, Gulf Oil Corp.'s district production manager in Oklahoma City, has been named production coordinator in the domestic production operations headquarters, Houston. **Eugene Hosford,** operations coordinator for the domestic production head-

PETREE

HOSFORD

quarters, has been named manager of the Houston production district. He succeeds **H. F. Beardmore,** who recently was elected vice president in charge of domestic production operations (see page 229). Petree joined Gulf in 1935 as a driller-helper. He was district engineer in Kilgore, Tex., and held managerial posts in Houston and Tulsa before his Oklahoma City assignment. Hosford has also been with Gulf since 1935. He was division coordinator of production in Fort Worth before moving to Houston last year.

C. F. Gerald has been named associate director of research for El Paso Natural Gas Products Co.'s research department. Gerald was with Universal Oil Products Co. before joining El Paso. **W. O. Beavers, L. E. Kidwell, Jr.,** and **Walter E. Steinmetz** have joined the company as research chemists. Beavers was formerly with Olin Mathieson Chemical Corp.; Kidwell was with Southwest Research Institute; and Steinmetz was with Nalco Chemical Co.

Dr. J. E. Goodrich, Dr. D. G. Rea, and **Dr. Roger S. Porter,** research chemists at California Research Corp.'s Richmond, Calif., laboratory, have been promoted to senior research chemists there. Rea and Porter will be in the analytical and physical-measurements section. Goodrich will be in chemicals-exploratory research.

Rudolph W. Edmund, general manager of the exploration department of Standard Oil Co. (Ohio) with headquarters in Oklahoma City, has resigned to join the faculty of his alma mater, Augustana College, Rock Island, Ill. Edmund headed the geology department of Augustana from 1948-51. He was regional geologist for Globe Oil & Refining Co. before joining Ohio Standard in 1953.

Gage Averill, formerly vice president of catalyst sales for Nalco Chemical Co., has been named director of sales for Houston Chemical Corp. **Russell E. Metzger** has been named sales manager for the southwestern division in Houston. He had been with Colorado Fuel & Iron Corp. **E. Paul Wilkinson** will be assistant sales manager in the southern division. **Ray R. Wible** has been named Midwest division sales manager in Chicago. His assistant sales manager will be **Roy Wood,** formerly vice president of Franklin Supply Co.

P. J. LaMarche, director of production for U. S. Industrial Chemicals Co., has been elected vice president in charge of production. LaMarche has been with USI since 1949. He was manager of the company's Ashtabula, Ohio, plants before being named director of production in 1958.

Sam Robertson, Abilene, Tex., independent operator, has been reelected president of the West Central Texas Oil and Gas Association. **Ralph Bridwell,** Abilene, and **Jack Patton,** Rotan, were named vice presidents. **William N. Tindell** and **James E. Russell** were reelected vice presidents, and **Bailey Lewis,** Abilene, was reelected treasurer. **Kirk Jordan,** executive secretary, also of Abilene, was given a new title of executive vice president.

ROBERTSON

L. Claude Roark has been named area exploration manager in Buffalo Petroleum Corp.'s new Denver division office. **E. E. Nowell** is area land manager, Denver.

Henry B. Elliott, assistant manager of the industrial products division in Atlantic Refining Co.'s domestic marketing department, has moved up to manager, industrial products. He succeeds **George Landis,** who has retired.

Bob Neu, head of the elastomers products and applications section in Esso Research & Engineering Co.'s chemical research department, has been transferred to Esso Export Corp., where he will be chemicals coordinator in the chemicals department supply division. **Roy Westlund,** head of Esso Research's plastics products and applications section, will succeed Neu. **John Johnson,** head of the polymers process research section, will move to plastics products and applications, succeeding Westlund. Neu has been with Esso Research since 1955 and had headed the elastomers products and applications section since 1958. He also has been with Atlantic Refining Co.

Deaths

Mark H. Plummer, 59, division manager for Pure Oil Co. in Olney, Ill., died November 5 in a car-truck crash near Olney.

William Bert Simpson, 68, retired engineer at Gulf Oil Corp.'s Kiefer, Okla., pressure-maintenance plant, died November 3 in a Muskogee, Okla., hospital. Simpson retired in 1957 after 35 years with Gulf.

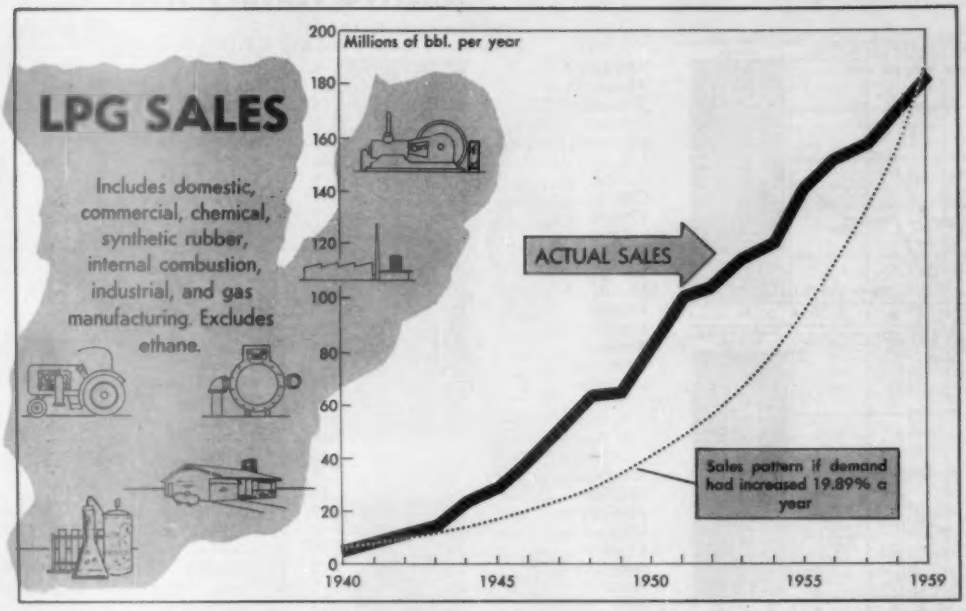
Louis E. Hanson, 66, retired general comptroller of Socony Mobil Oil Co., died October 22 in a Kansas City hospital. Hanson was with White Eagle Oil & Refining Co. before it was merged with Socony Mobil. He retired in 1955.

Howard M. (Mickey) Buchman, 41, director of Bingham Gas & Oil Co., Salt Lake City, died October 21 at his home after a long illness.

John C. Walker II, retired research director for Cities Service Co., died October 31 at his home in Westfield, N. J. Walker retired in 1958 after 41 years with Cities Service.

William T. Powell, 75, retired purchasing department employe of Union Oil Co. and Texaco Inc., died November 2 in Hilo, Hawaii. Powell was in the oil industry for 40 years before his retirement in 1955.

J. C. (Jake) Minyard, formerly general superintendent for River Construction Corp., in Weatherford, Tex., died November 4 in Weatherford after a heart attack. Minyard was connected with River Construction and its predecessor, O. C. Whitaker Co., for many years.



Take another look at 1959 LPG sales

BY JOHN C. CASPER

SALES OF LPG topped 7.5 billion gallons last year for the first time, up almost 1¾ billion over the past 4 years. This is continuing proof that gas liquids is one of the fastest-growing segments of the petroleum industry.

But even with its outstanding growth rate the annual increases over the past 20 years have tended more toward constant annual volumetric gains than constant percentage gains.

Take a look at the chart. The top line gives a picture of actual sales for domestic, commercial, chemical, synthetic-rubber, internal-combustion, industrial and gas-manufacturing uses. Consumption for refinery fuel and for secondary recovery of petroleum has been excluded because they represent uses within the petroleum industry.

Back in 1940, sales of LPG on this basis accounted for only a small part of petroleum demand. The total for the year was a little less than 10 million barrels. By 1950, sales had climbed to almost 80 million barrels—sales at the end were eight times sales at the start of the 10-year period. Over the past 9 years sales moved up from 80 million barrels to a little over 180 million barrels, or a little more than doubled. While this increase in recent years has been at a much faster pace than the growth in total petroleum demand, it has not reached the gain rate of LPG in the forties.

If sales had followed a constant-percentage-gain curve for the past 20 years, demand would have risen only to about 40 million barrels by 1950 and would have climbed much faster in recent years.

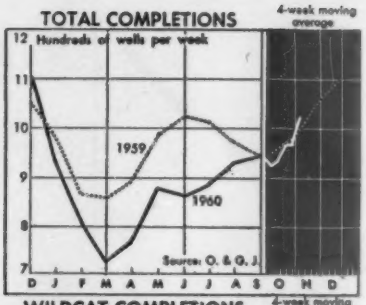
The latest report on LPG sales by the Bureau of Mines can be slightly misleading if taken at face value without close study. First there are two uses that have been picked up in recent years with no data for back years. These are refinery fuel and secondary crude recovery.

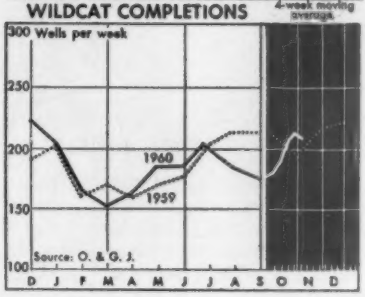
The use of LPG in flooding operations may produce a statistical problem in coming years. Injections of LPG in secondary-recovery operations represents a current use or disappearance of LPG, but the material may be counted again in the future when this same LPG is produced along with the crude.

Also the inclusion of ethane for the first time in 1959 tends to give an abnormal boost to chemical use of LPG. Actually chemical use of propane-and-heavier LPG was less in 1959 than in 1958. The bureau's report shows total LPG for chemical use rising from 1,899 million gallons in 1958 to 2,526 million in 1959. But, this 1959 figure included 784 million gallons of ethane, and ethane was not included in 1958. If we take the ethane out of the 1959 total we find chemical use dropping from 1,899 million gallons in 1958 to 1,742 million in 1959.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,952,685	UP	114,500	UP	1,926
Crude stocks	230,809,000	UP	993,000	DOWN	25,490,000
Completions	1,077	UP	125	DOWN	39
Refinery runs	7,830,000	DOWN	104,000	UP	149,000
Gasoline stocks	184,350,000	DOWN	2,525,000	UP	8,550,000
Kerosine stocks	36,745,000	UP	119,000	UP	3,981,000
Distillate stocks	180,453,000	UP	1,529,000	DOWN	1,171,000
Residual stocks	49,079,000	DOWN	838,000	DOWN	8,720,000
Four-product stocks	450,627,000	DOWN	1,715,000	UP	2,640,000
Total imports	1,657,200	UP	138,600	UP	339,200





Active Rotary Rigs

	11-7-60	10-31-60	11-9-59
Alabama	3	1	6
Alaska	7	7	(†)
Arkansas	14	12	16
Arizona	2	2	1
California	70	70	91
Land	67	67	84
Offshore	3	3	7
Colorado	50	54	46
Florida	3	3	3
Land	2	2	2
Offshore	1	1	1
Georgia	2	1	0
Illinois	46	47	43
Indiana	8	10	9
Iowa	1	1	0
Kansas	99	105	146
Kentucky	6	4	7
Louisiana	265	271	309
North	32	33	39
S. Inland waters	105	104	109
S. Land	73	75	105
Offshore	55	59	56
Maryland	0	0	0
Michigan	29	26	39
Mississippi	58	57	72
Missouri	2	1	0
Montana	25	28	30
Nebraska	19	24	27
Nevada	0	0	1
New Mexico	100	97	120
New York	2	2	0
North Dakota	15	17	21
Ohio	6	5	2
Oklahoma	168	166	224
Oregon	0	0	0
Pennsylvania	10	6	12
South Dakota	1	0	6
Texas	611	569	755
S. Inland waters	12	8	4
S. Land	151	141	190
Offshore	2	1	2
North	38	38	188
Panhandle	58	48	(*)
East	53	56	(*)
West Central	172	167	216
West	125	110	155
Utah	29	30	30
Washington	1	1	1
West Virginia	9	9	5
Wisconsin	1	1	0
Wyoming	70	76	89
Total U. S.	1,732	1,703	2,111
Western Canada	139	142	165
Eastern Canada	0	1	1
Grand total	1,871	1,846	2,277

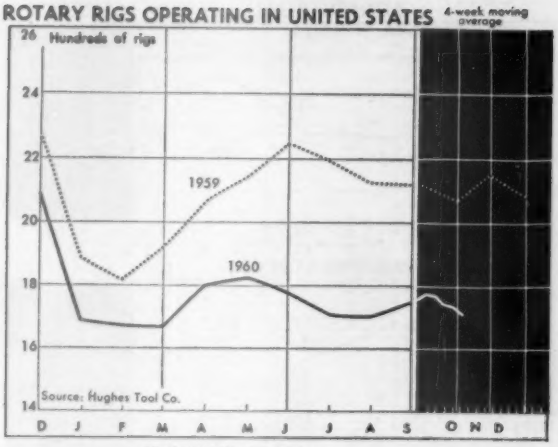
Hughes Tool Co. report. *Included in North. Comparisons not available due to change in method of reporting. †Data first reported 4-4-60.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED NOVEMBER 5, 1960

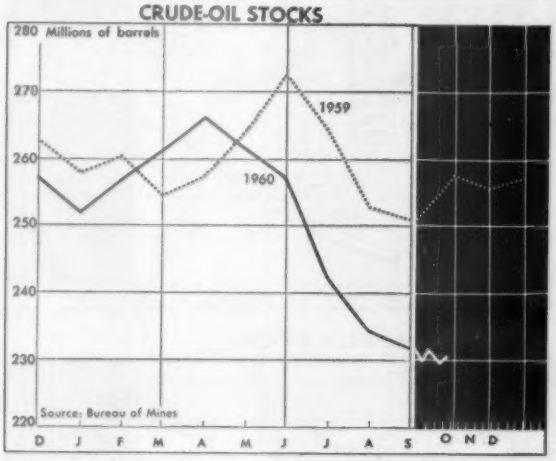
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Alabama	1	0	0	0	1	0	460	40	82	1	0	0	0	1	5	20
Arizona	3	0	0	1	2	0	3,468	32	24	0	0	0	0	0	19	22
Arkansas	20	12	0	0	8	0	62,801	518	719	4	1	0	0	3	131	125
California	52	33	0	7	12	0	208,854	1,426	1,312	7	0	0	1	6	259	345
Colorado	22	2	0	8	12	0	107,961	549	661	6	2	0	0	4	278	371
Illinois	43	10	0	0	18	15	90,100	1,948	2,002	8	2	0	0	6	411	333
Indiana	28	11	0	0	16	1	32,613	906	714	7	0	0	0	7	327	243
Kansas	121	73	0	2	21	25	224,141	3,419	3,377	15	3	0	1	11	889	894
Kentucky	36	9	0	8	19	0	53,905	1,806	2,346	5	0	0	0	5	191	285
Louisiana	60	23	5	0	32	0	434,812	3,058	3,188	12	0	1	0	11	476	439
North	24	6	2	0	16	0	103,740	1,169	1,253	6	0	1	0	5	228	198
South	31	13	2	0	16	0	291,418	1,469	1,591	6	0	0	0	6	220	226
Offshore	5	4	1	0	0	0	39,654	420	344	0	0	0	0	0	28	15
Michigan	24	8	0	2	13	1	85,377	805	562	5	0	0	0	5	218	154
Mississippi	13	3	0	0	10	0	116,569	581	551	7	0	0	0	7	225	241
Montana	9	4	0	0	5	0	44,496	283	280	3	0	0	0	3	131	91
Nebraska	18	7	0	0	11	0	96,904	752	773	6	2	0	0	4	324	336
New Mexico	36	21	0	10	4	1	180,900	1,589	1,770	2	0	0	0	2	222	204
West	16	3	0	10	2	1	75,995	568	798	1	0	0	0	1	62	53
East	20	18	0	0	2	0	104,905	1,021	972	1	0	0	0	1	160	151
New York	22	13	0	0	2	7	29,700	280	237	0	0	0	0	0	38	19
North Dakota	4	0	0	0	4	0	29,822	252	381	2	0	0	0	2	70	68
Ohio	25	13	0	7	5	0	63,390	916	923	0	0	0	0	0	44	26
Oklahoma	111	51	1	10	35	14	345,122	3,925	4,733	15	3	0	0	12	606	722
Pennsylvania	0	0	0	0	0	0	0	592	441	0	0	0	0	0	13	10
South Dakota	0	0	0	0	0	0	0	21	15	0	0	0	0	0	10	7
Texas	300	165	16	13	100	6	1,299,305	13,289	15,998	51	5	0	1	45	2,728	3,007
Dist. 1	18	6	2	2	8	0	55,568	944	918	4	0	0	0	4	341	285
Dist. 2	14	3	5	1	5	0	119,119	649	673	4	1	0	0	3	161	201
Dist. 3	21	12	4	0	5	0	168,704	1,007	1,016	1	0	0	0	1	188	201
Dist. 4	14	4	2	1	7	0	68,798	902	1,143	7	0	0	1	6	253	275
East	34	27	0	0	7	0	139,972	1,097	1,091	4	0	0	0	4	227	206
Dist. 7-B	26	12	0	0	14	0	81,861	1,894	2,217	7	2	0	0	5	534	592
West	84	55	1	1	23	4	418,791	3,404	4,829	19	0	0	0	19	534	661
Dist. 9	60	29	1	0	28	2	136,734	2,489	3,005	5	2	0	0	3	440	494
Dist. 10	29	17	1	8	3	0	109,758	903	1,106	0	0	0	0	0	50	92
Utah	6	4	0	1	1	0	38,860	199	259	1	0	0	0	1	73	72
West Virginia	*92	13	0	63	11	5	193,261	744	670	1	0	0	0	1	8	27
Wyoming	27	13	0	2	12	0	140,611	900	834	6	0	0	0	6	364	295
Misc. (Alaska)	4	3	0	0	1	0	36,415	145	82	1	0	0	0	1	124	55
Total U. S.	1,077	491	22	134	355	75	3,909,847	38,975	42,934	165	18	1	3	143	8,184	8,411
Previous week	952	417	32	75	379	49	3,748,221	.....	.....	228	27	3	6	192	.....	.....
Cum. 1960	38,975	17,590	1,130	3,251	14,819	2,185	161,111,726	.....	.....	8,184	742	88	273	7,081	.....	.....
Cum. 1959	42,934	21,382	1,046	3,185	16,105	1,216	177,565,746	.....	.....	8,411	755	96	274	7,286	.....	.....
Western Canada	62	48	0	6	7	1	343,636	1,966	2,079	7	1	0	2	4	515	573

*Incl. 2 weeks lag.

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	10-29-60	10-22-60	10-31-59
Pennsylvania	2,280	2,345	2,509
Other Appalachian	1,473	1,479	2,145
Illinois, Indiana, Michigan	8,869	8,538	10,155
Nebraska and North Dakota	2,605	2,626	3,223
Kansas	8,420	8,514	9,817
Oklahoma	14,652	15,083	15,841
Arkansas	1,696	1,746	2,184
Louisiana	18,207	17,480	18,911
North	2,905	3,039	3,339
South	15,302	14,441	15,572
Mississippi, Alabama, Florida	1,861	1,905	2,364
New Mexico	8,361	8,433	8,427
Texas	98,081	97,372	111,295
East Texas	7,608	7,496	7,889
West Texas	47,670	47,123	53,150
Texas Gulf	16,589	17,025	19,255
Other Texas	26,214	25,728	31,001
Wyoming	14,978	14,714	16,157
Other Rocky Mountain	9,792	9,555	9,546
California	25,911	25,575	28,133
Foreign	†13,623	14,451	15,592
Total	**230,809**	229,816	256,299

*Bureau of Mines. †Includes 4,843,000 bbl. in California.

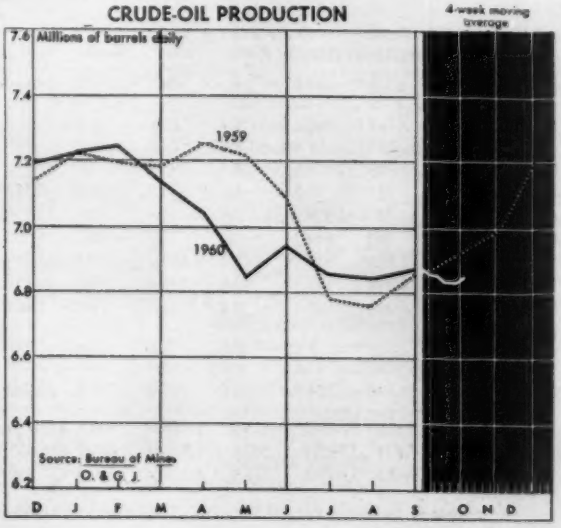
DAILY AVERAGE PRODUCTION FOR WEEK

	November 5, 1960			Oct. 29 total
	Crude oil	Lease condensate	Total	
Alabama	21,625	.....	21,625	19,900
Arkansas	77,175	200	77,375	77,325
California	826,000	.....	826,000	825,900
Colorado	130,700	.....	130,700	132,700
Eastern	41,300	.....	41,300	40,900
Florida	975	.....	975	1,000
Illinois	221,800	.....	221,800	219,400
Indiana	32,300	.....	32,300	32,400
Kansas	†309,260	.....	†309,260	†304,660
Kentucky	57,000	.....	57,000	57,000
Louisiana	957,700	133,400	1,091,100	1,071,450
North	104,700	5,900	110,600	110,700
South	853,000	127,500	980,500	960,750
Michigan	45,800	.....	45,800	43,800
Mississippi	140,850	3,950	144,800	137,800
Montana	83,200	.....	83,200	82,700
Nebraska	67,050	.....	67,050	67,400
Nevada	50	.....	50	50
New Mexico	286,700	8,700	295,400	293,700
North Dakota	63,100	.....	63,100	65,000
Oklahoma	†513,600	.....	†513,600	†492,000
Texas	2,355,000	87,200	2,442,200	2,413,575
Dist. 1	43,000	3,200	46,200	45,500
Dist. 2	98,150	8,300	106,450	105,100
Dist. 3	299,850	38,000	337,850	333,500
Dist. 4	169,575	12,200	181,775	180,900
Dist. 5	25,000	500	25,500	25,300
Dist. 6	101,575	9,800	111,375	111,000
East Texas field	123,275	.....	123,275	121,000
Dist. 7-B	121,000	250	121,250	121,150
Dist. 7-C	114,575	3,050	117,625	117,050
Dist. 8	963,425	9,000	972,425	955,500
Dist. 9	195,150	1,800	196,950	195,650
Dist. 10	100,425	1,100	101,525	101,925
Utah	122,425	.....	122,425	94,500
Wyoming	364,000	.....	364,000	363,400
Others	‡1,625	.....	‡1,625	‡1,625
Total U. S.	6,719,235	233,450	**6,952,685**	6,838,185
Change from previous week, up			**114,500**	
Canada	†443,500	.....	†443,500	†486,798

Total U. S. production—Jan. 1-Nov. 5 2,173,345,400
Same period last year (crude plus cond.) ..... *2,176,956,400 bbl.

*Includes 58,015,600 bbl. condensate. †Week ended previous Monday. ‡Alaska, South Dakota, and Arizona.

CRUDE-OIL PRODUCTION



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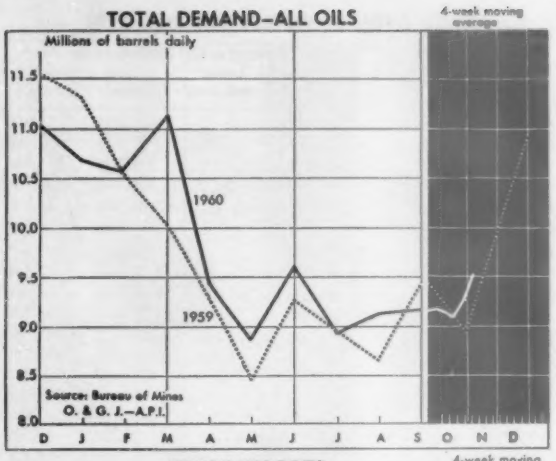
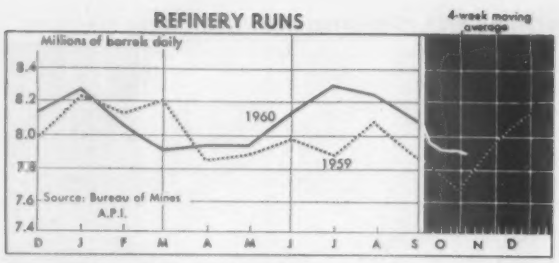
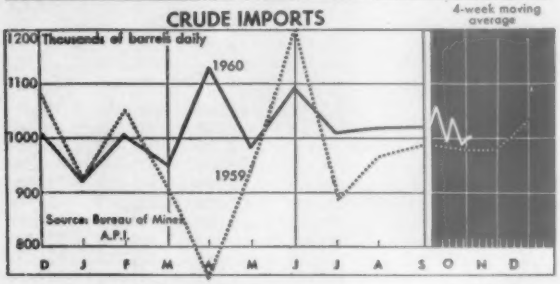
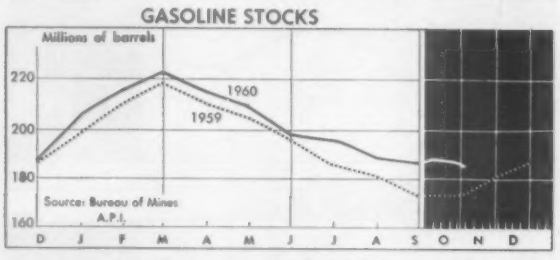
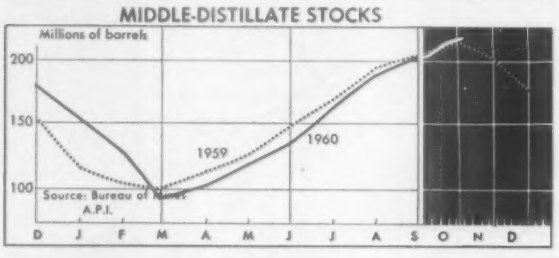
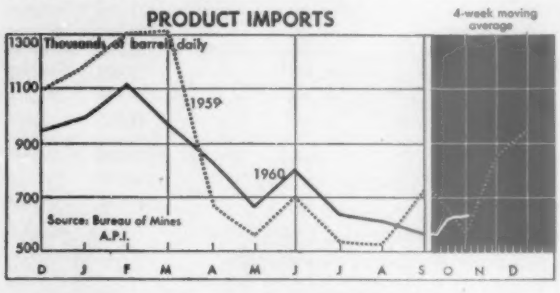


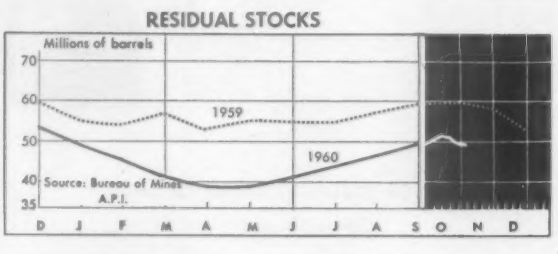












API REFINERY REPORT—NOVEMBER 4, 1960

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, November 1959—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,109	483.9	28.3	349.3	143.1	44,430	15,119	71,950	12,967	1,141	515.8	36.4	340.1	155.2
Appalachian:														
District 1	68	30.4	3.4	12.1	6.7	5,417	794	4,623	490	93	39.0	3.6	20.9	12.2
District 2	106	61.9	3.6	22.0	13.9	3,003	498	1,877	270	92	53.2	5.3	19.3	14.4
Ind., Ill., Ky. ..	1,364	684.6	74.9	297.4	152.0	30,016	7,524	32,250	6,816	1,464	758.6	78.5	323.1	195.3
Minn., Wis., Dak.	121	55.3	4.1	28.9	18.4	6,357	1,685	8,945	607	113	56.2	5.5	26.8	20.0
Okla., Kans., Mo.	653	359.9	9.0	152.4	16.0	15,836	1,704	14,546	1,017	695	372.8	14.5	187.6	28.3
Inland Texas ..	242	206.1	8.0	37.7	14.1	6,705	670	1,685	2,565	291	214.4	11.2	48.2	19.5
Tex. Gulf Coast	1,926	983.8	148.1	469.7	149.0	24,789	3,539	18,627	5,890	1,827	935.2	109.6	450.9	142.0
La. Gulf Coast..	690	343.7	94.6	133.1	49.7	10,450	2,389	5,988	1,512	714	376.6	57.7	165.6	49.1
N. La. and Ark.	105	55.4	6.4	21.7	6.6	5,407	1,017	2,854	140	75	34.8	2.7	19.1	6.6
Rocky Mountain:														
New Mexico..	15	7.9	0.6	2.7	2.6	771	44	131	18	26	15.2	0.5	4.9	3.1
Other Rky. Mt.	285	142.1	5.3	66.4	34.7	5,126	368	3,306	1,097	292	137.8	4.0	64.7	36.7
West Coast	1,146	554.3	40.6	172.6	235.6	26,043	1,394	13,706	15,690	1,161	552.2	3.6	163.6	289.2
Nov. 4, 1960	7,830	3,969.3	426.9	1,766.0	842.4	184,350	36,745	180,453	49,079	7,984	4,061.8	333.1	1,834.8	971.6
Oct. 28, 1960	7,934	3,995.4	362.1	1,850.9	816.7	186,875	36,626	178,924	49,917	.....	.....	.....	.....	.....
Nov. 6, 1959	7,681	3,939.3	323.9	1,726.1	869.4	175,800	32,764	181,624	57,799	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.86	....	....	....	....	....	....	....	....
15-15.9	1.93	....	....	....	....	....	....	....	$1.81
16-16.9	2.00	....	....	....	....	....	....	....	1.86
17-17.9	2.06	....	....	....	....	....	....	....	1.91
18-18.9	2.13	....	....	....	....	....	....	....	1.96
19-19.9	2.20	....	....	....	....	....	....	....	2.01
20-20.9	2.27	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.33	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.40	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague.

Flat Prices

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.23-3.53
Van	3.08
Pennsylvania Grade:	
Bradford	$4.75-4.80
Middle District	4.52
Southwest Pennsylvania	4.25
West Virginia	4.17
Buckeye Grade	4.08
Illinois Basin	**3.00-3.05**

Foreign

Middle East, Persian Gulf: (cargoes f.o.b. lifting port)	
Arabian, 34.0°-34.9°, Ras Tanura	$1.80
Iranian, 34.0°-34.9°, Bandar Mashur	1.78
Iranian, 34.0°-34.9°, Abadan	1.73
Iraq, 35.0°-35.9°, Fao	1.72
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.59
Qata, 41.0°-41.9°, Umm Said	1.95
Middle East, E. Mediterranean:	
Arabian, 34.0°-34.9°, Sidon	$2.17
Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli	2.19
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 36°	2.42
Canada:	
Leduc-Woodbend	$2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38
Venezuela:	
Cumbarebo, 47°-47.9°, Tucupido	3.34
San Joaquin, 40°-40.9°, Puerto La Cruz	3.08
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

★ Gulf-N. Y., dirty (ATRS—35%)	$1.85
PG-Japan, dirty (USMC—60%)	4.08
★ Carib.-N. Y., dirty (ATRS—52.5%)	1.78
PG-UK, dirty (Scale—40%) (34s 11d.)	4.90

★Denotes change from previous week.

Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):	
Regular (91 octane)	$12.25-12.50
Premium (99 octane)	15.00-15.25
Natural gasoline (26-70)	4.5
Breckenridge	4.0
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	11.00
Regular (92 octane)	11.25
Premium (98 octane)	12.25
California (rack) Los Angeles:	
Regular (88 octane)	11.65-12.15
Premium (94 octane)	12.65-13.15
Premium (100 octane)	14.00-14.65
Caribbean area (cargoes):	
Regular (87 octane)	10.125-10.25
Premium (97 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):	
Kerosine 42-44	10.375
Diesel oil (58 d.i. and above)	10.00
Distillate No. 1	10.00
Distillate No. 2	9.00
Gulf Coast (cargoes):	
Kerosine 41-43	9.00- 9.25
Distillate No. 2	8.25
New York Harbor (barges):	
Kerosine 41-43	10.45
Distillate No. 2	9.45
Diesel fuel, 48-52 d.i.	9.65
Caribbean area (cargoes):	
Distillate No. 2	8.125

Residual Fuel (Bbl.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.90
Gulf Coast (cargoes):	
Bunker C fuel	2.30
New York Harbor (barges):	
Bunker C fuel	2.52
Caribbean (cargoes):	
Bunker C	2.10
California (rack):	
Bunker C fuel, Los Angeles	2.25

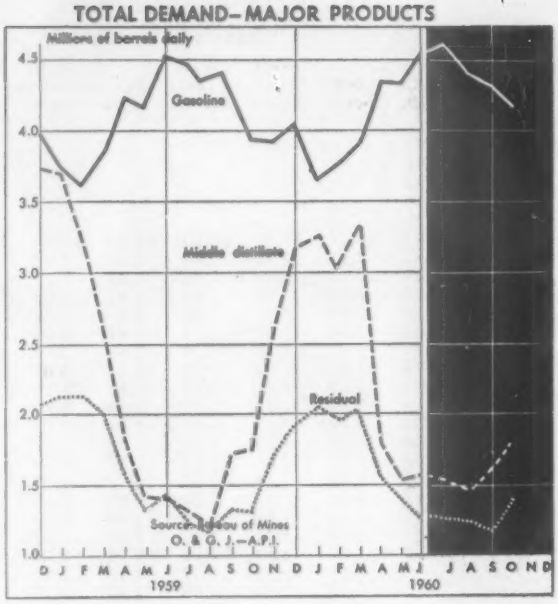
SELECTED MONTHLY DATA

SUPPLY AND DEMAND—MAJOR PRODUCTS
(Thousands of barrels daily)

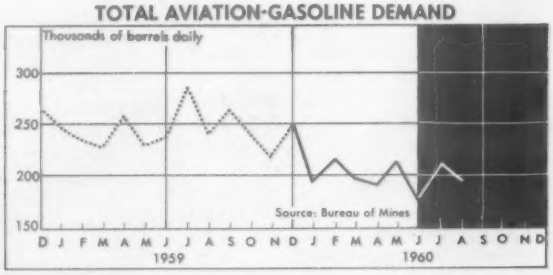
	Total demand	Refinery production	Stocks end of period†
GASOLINE			
October 1960*	4,190	4,015	185,400
September 1960*	4,310	4,170	187,500
August 1960	4,501	4,287	190,322
November 1959	3,920	4,095	181,016
October 1959	3,953	3,931	174,277
KEROSINE			
October 1960*	340	385	36,700
September 1960*	315	365	35,200
August 1960	277	368	33,379
November 1959	393	333	30,701
October 1959	261	287	32,396
DISTILLATE			
October 1960*	1,455	1,765	179,800
September 1960*	1,310	1,830	169,000
August 1960	1,222	1,874	152,158
November 1959	2,225	1,835	171,114
October 1959	1,515	1,736	181,840
RESIDUAL			
October 1960*	1,400	815	49,400
September 1960*	1,245	875	50,400
August 1960	1,230	843	47,177
November 1959	1,716	972	58,587
October 1959	1,315	869	59,506

*Preliminary. †Thousands of barrels.

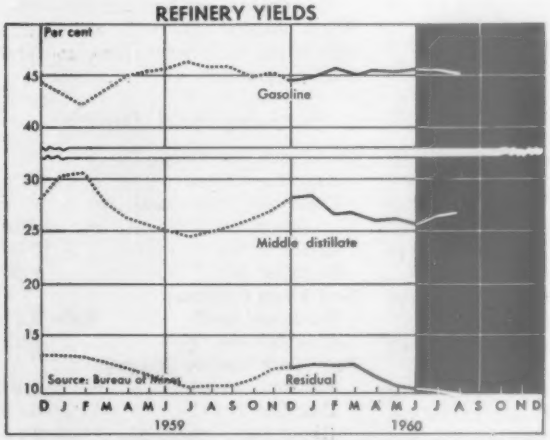
TOTAL DEMAND–MAJOR PRODUCTS



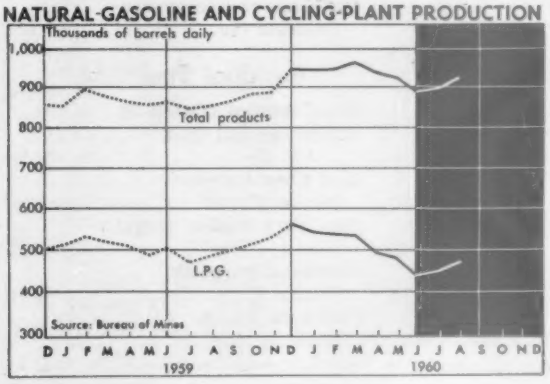
TOTAL AVIATION-GASOLINE DEMAND



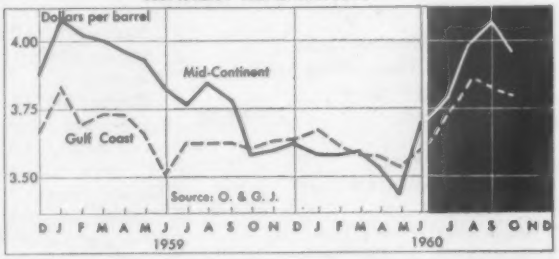
REFINERY YIELDS



NATURAL-GASOLINE AND CYCLING-PLANT PRODUCTION



REFINERY REALIZATION



REFINERY REALIZATION

	Oct.*	Sept.*	Aug.	July
Mid-Continent	$3.96	$4.07	$4.02	$3.75
Gulf Coast	3.80	3.83	3.83	3.84

*Preliminary. Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel, and residual as published in The Oil and Gas Journal.

- One of the major PEMEX projects nearing completion is a 941-mile, 24-inch dry natural gas line from the absorption plant in Ciudad Temex, Tabasco, to Mexico City, with a 165-mile, 14-inch extension to the farming and industrial areas of Salamanca.

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30—HEAT EXCHANGERS—62 to 4,000 sq. ft. per shell—10# to 400# WP

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1—CARRIER 400 HP REFRIGERATION COMPRESSOR — turbine drive

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FOR SALE: Wagner-Morehouse portable drilling, workover, and pulling rig, with transmission, torque converter, air clutches, drilling line, sandline, blocks, hook, automatic catheads, 96 ft. mast, subbase, table. Trailer mounted. White tractor. $45,000. Terms. 1705 Burton Way, Bakersfield, Calif.

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TUESDAY—NOV. 29, 1960—10:00 A.M.

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1—C250 (7½ x 15) National power pump, S/N 5958

1—Gardner Denver (FX—FXH) 7½ x 14 power pump, S/N 102746 powered by a 6 NKU Waukesha with starting engine S/N 728093

127' Lee C. Moore jacknife mast with 10' x 45' substructure, S/N W.O.4541-3

Rig #2: 1—68 500—34 Emsco drawworks, S/N 144 with 3—6 NKR Waukeshas and compound.

1—3 FQ—FXQ 7½ x 16 Gardner Denver Pump S/N 124160

1—National C 250 (7½ x 15) standby pump

1—Lee C. Moore 131' jacknife mast with 10' x 46' substructure

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1—4½ x 6 Waukesha pump with WBNM Int. engine

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1—National 50 drawworks with Hydraumatic brake

1—Caring sand reel, skd., mtd. with (1) Waukesha

1—Beaumont iron works #12 steam driven drawworks

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1—1955 International R 190

1—Dodge Gin Pole Truck—oilfield bed—4" gin poles—rolling tailboard— Tulsa winch—butane.

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(Manuals Editor)

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The Oil and Gas Journal

Tulsa, Oklahoma

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Tulsa, Oklahoma

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Tulsa, Oklahoma

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LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Cheyenne, Wyoming. Notice is hereby given that three parcels of land totaling 400 acres, within the known geologic structures of the East Adams Ranch and Hugoton fields, Meads and Morton Counties, Kansas, are offered for competitive oil and gas leasing through sealed bids to the qualified bidder of the highest cash amount per acre at 2:00 P.M., MST, December 15, 1960, when bids will be opened. Full details of the offering, and how and where to submit bids, may be obtained from the Land Office, Cheyenne, Wyoming. Arvin H. Olswold, Chief, Minerals Adjudication Unit.

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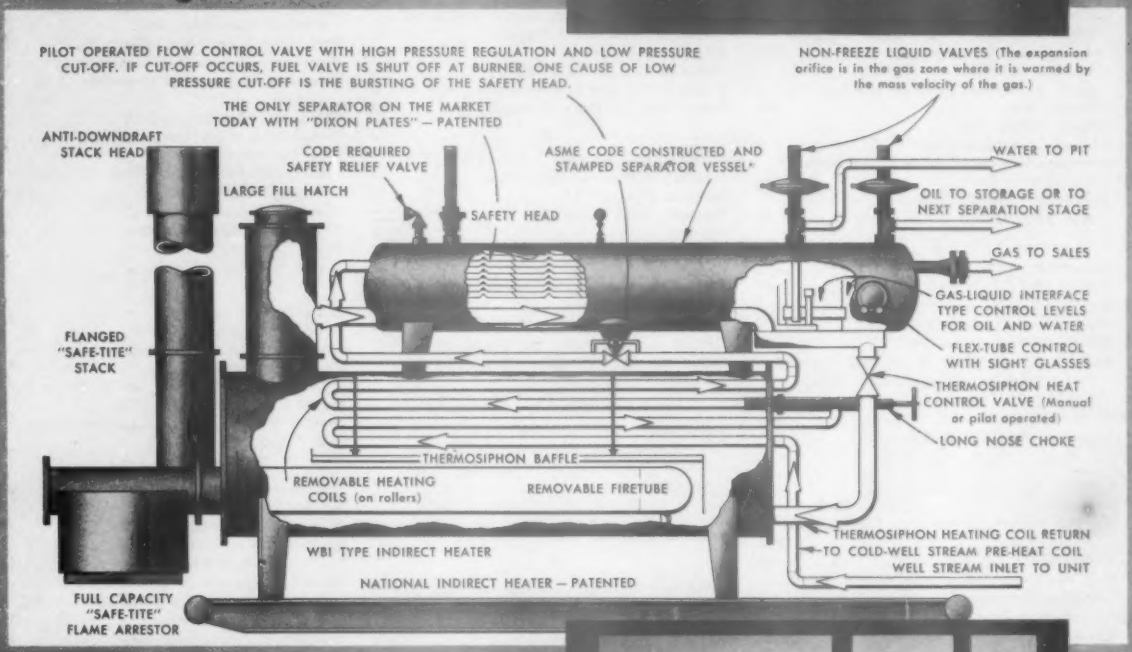
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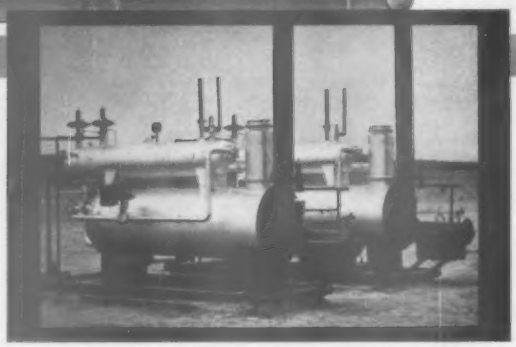
NATIONAL INDIRECT HEATER — PATENTED
FULL CAPACITY "SAFE-TITE" FLAME ARRESTOR



National Thermosiphon Stak-Paks are composed of standard separator and indirect heater units. They are available in combinations of two or three-phase horizontal separators together with any size indirect heater. Completely skid mounted and pre-piped, the ASME code stamped separator is not immersed in the water bath of the heater but is placed above. Glycol protected water bath will not freeze. No housing or insulation needed in moderate climates such as Oklahoma, Kansas and Texas.

The Stak-Pak is available with all controls and valves manufactured by National . . . one supplier — one source . . . non-freeze type liquid valves, FLEX TUBE® liquid level controls, interface level controls, long nose chokes and many others

PLUS National's 'Safe-Tite' Flame Arrestors and safety-drilled return bends in heating coils.

For complete information and colored flow diagram on the all-new National Thermosiphon Stak-Pak, contact your nearest National Tank Company branch or write direct to . . .

It's a National®

NATIONAL TANK COMPANY

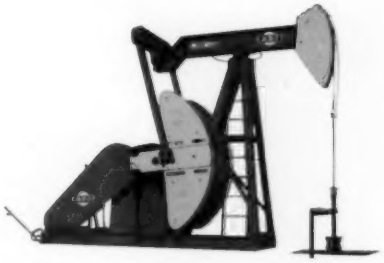
DRAWER 1710

TULSA, OKLAHOMA

CABOT 'ROUND-THE-CLOCK Field Service

Day or night . . . 365 days a year . . . Cabot backs each pumping unit with 'Round the Clock field service. This is important because the value of a pumping unit . . . *any pumping unit* . . . is only as good as the service that stands behind it. Cabot has a network of first class service centers throughout the oil country. These centers carry complete stocks of Cabot parts which are taken quickly to your location in special trucks and installed by Cabot factory trained personnel.

If you agree that service is important . . . better try Cabot.



OIL FIELD PUMPING EQUIPMENT
CABOT
PAMPA, TEXAS
FRANKS

CABOT CORPORATION
MACHINERY DIVISION

COST *conscious...?*

If you are watching costs more closely than ever before . . . you're not alone. The oil patch is turning to old-fashioned frugality in seeking ways to cut drilling costs.

That's why so many users of Hughes bits, among the contractors and oil companies, are setting up *cost-saving* engineered bit programs with the help of their local Hughes representatives.

These programs are aimed at saving drilling time and bit costs by getting the most out of every bit run, and by making the maximum effective use of the equipment the operator has on hand.

So, if you are interested in keeping hole costs down, you'll find the best place to start is with high-performance Hughes bits and Hughes service.

HUGHES TOOL COMPANY ORIGINATOR AND

WORLD'S LEADING DEVELOPER OF CONE-TYPE ROCK BITS